agriculture

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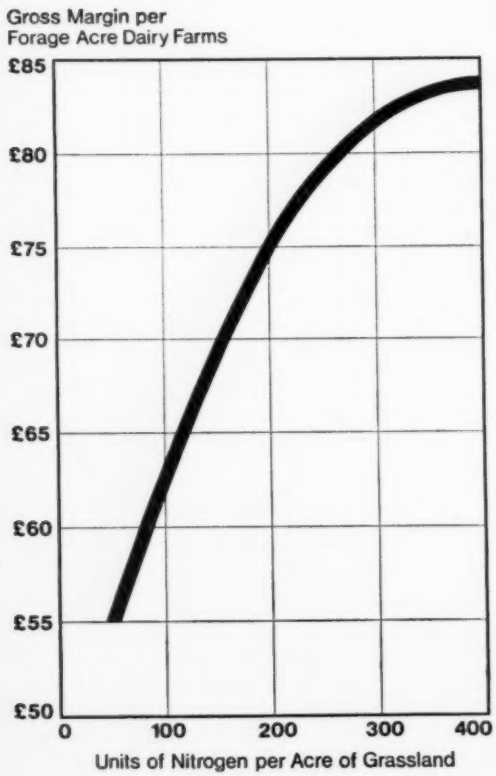
Nitrogen-

The key to profitable milk production



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Agriculture

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FOREWORD *by*

The Right Honourable Joseph Godber, M.P.
The Minister of Agriculture, Fisheries and Food

THIS is the last issue of *Agriculture*. It is sad to record its end after seventy-eight years of regular and useful publication, but the intention is that its successor—the new Ministry journal which will replace it shortly—will prove more comprehensive and reflect far better the changed responsibilities of the Department.

Agriculture was introduced by the original Board of Agriculture in September 1894. Since then it has maintained a flow of valuable technical information and advice on agricultural and horticultural subjects mainly of interest to farmers and growers.

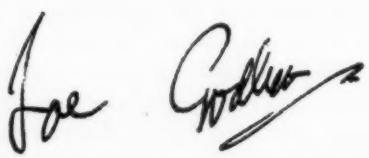
Since its earlier days, however, the Department has evolved in its status and responsibilities. The Board of Agriculture first absorbed responsibility for fisheries in 1903; became the Ministry of Agriculture and Fisheries in 1919; played a vital role during the second World War; joined with the Ministry of Food in 1955; emerging today as a major economic Department of State with important responsibilities for looking after the nation's food supplies.

During these years, and increasingly during the last quarter of a century, great technological advances have been made in all aspects of the agricultural, fishing and food industries. These have been attended by a corresponding growth in the number of technical publications from all sources, including the Ministry's own professional, scientific and technical services. The original function of *Agriculture* has thus been gradually superseded.

At the same time a new need has emerged for communication on a much wider scale to the three industries and, through them, to consumers. Entry into Europe will increase this need. We shall be working in a new economic environment. The Ministry is involved at the very heart of European affairs and over the next few years will have a great deal of information to disseminate about the effects and implications of EEC entry.

It is for these reasons that we have decided that this is the right moment to bring *Agriculture* to an end and to embark instead on a new and more broadly based publication, with two main purposes. The first is to provide a means of communication between the Ministry and the agricultural, fishing and food industries on matters of interest across the whole panorama of food production, processing, manufacture and distribution, right through to the consumer. Secondly, it will provide a forum, which I hope will be increasingly used, for the industries themselves and consumers to contribute articles and views, comments and ideas for information and discussion. It will carry news articles, information about Government policy, details of Ministry activities and statistical information. Its international outlook will provide a valuable insight into what is going on in other parts of the world, particularly Europe. It will encourage discussion and debate on the current situation, on trends and on future possibilities.

In conclusion, I would like to give my sincere thanks to all who have contributed to the success of *Agriculture* over the years, and to express the hope that readers of *Agriculture*, as well as many new readers, will find the new journal, *Food*, of great interest and value.



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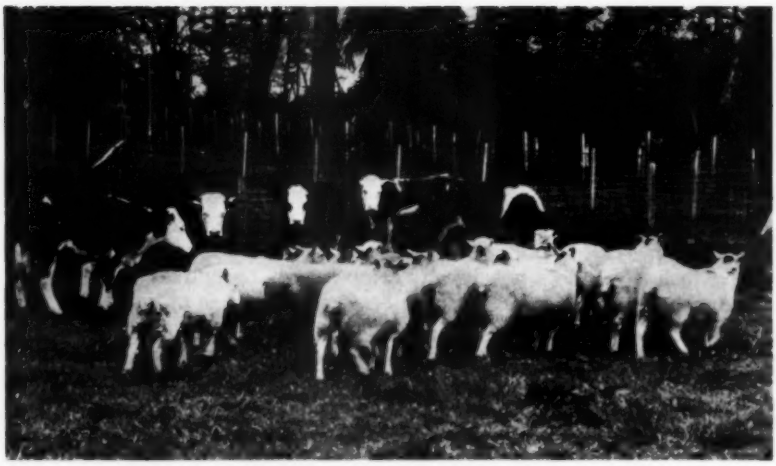

Mixed grazing—cattle and sheep

EXPERIMENTAL HUSBANDRY FARMS

Mixed Grazing

N. G. Lawrence

OVER the last twenty years highly productive ryegrasses have been selected and these, when used in high nitrogen systems, have the potential to produce around 15,000 lb of dry matter per acre per year. However, utilizing this enormous potential with the grazing animal has proved difficult. Selective grazing and subsequent ear emergence, dung and urine fouling, treading and poaching combine to drastically reduce the use of this output.

Paddock Grazing

Paddock grazing was suggested and tried as a means of limiting selective grazing. It worked, and at the same time allowed greater flexibility in grass management. In periods of 'flush', some paddocks could be taken out of the grazing system so that excess grass could be conserved. Nitrogen application became easy after each grazing and hence removed fears of nitrate poisoning. However, even with paddock grazing systems, it still proved difficult to achieve total liveweight gains in excess of 750 lb per acre per year when grazing either cattle or sheep by themselves. Any attempt to increase liveweight production per acre by increasing the stocking rate generally led to a reduction in individual animal performance, which declined as stocking rate increased so that eventually further additions to stock produced no extra financial return per acre. Unfortunately, at the high levels of grass production

now possible this tends to happen at stocking rates far lower than are necessary to utilize all the grass produced.

Stocking rates

At Trawscoed, work over the past fifteen years has shown that a good stocking rate for financial returns and livestock performance on self-sufficient paddock grazing systems is either about two fattening cattle or eight to nine Welsh Halfbred ewes with lambs. At Trawscoed, experiments have shown it possible to increase overall stocking rate by the introduction of another class of livestock which does not directly compete with the initial grazing stock. In other words, by adding sheep to a beef grazing system or beef to a sheep grazing system overall stocking rates have increased with no deleterious effects on animal performance. The grazing of the two classes of stock led to a greater flexibility in grassland management and hence allowed greater use of grass. This in turn resulted in an improved sward and superior animal performance in the region of 850 lb total liveweight gain per acre per year.

Table 1 summarizes the results of some of the previous work when three groups of grazing animals—cattle, cattle and sheep, and sheep alone—were each grazed at two different stocking rates.

Table 1

Stocking rate per acre	Beef production		Lamb production		Total production
	Total LWG per beast	Daily LWG per beast	Total LWG per lamb (b)	Total lamb production/ acre (c)	Total live-weight production/ acre
High	lb	lb	lb	lb	lb
3 Cattle	242	1·42	—	—	726
1½ Cattle + 4½ Ewes (a)	291	1·82	61·1	483	919
9 Ewes	—	—	59·6	947	947
Medium					
2½ Cattle	262	1·53	—	—	655
1½ Cattle + 3½ Ewes	285	1·78	61·5	392	743
7½ Ewes	—	—	58·8	776	776

(a) All ewes with 155 per cent lambing.

(b) Birth weight of lambs included.

(c) Birth weights included.

The cattle were Hereford × Friesian heifers which weighed approximately 500 lb at spring turn-out. The ewes were Welsh Halfbreds and were selected at lambing to give 155 per cent lambing. The grassland used in the experiment was a ley containing a high proportion of perennial ryegrass. The area was divided into six units, each with six paddocks and each paddock was grazed for three and a half days. Nitrogen was applied to every paddock at the rate of 300 units per acre per year and any surplus grass was conserved as silage and fed to the ewes which were housed during winter.

Liveweight gains

The data in Table 1 shows that the cattle on the mixed grazing treatment, whether on the high or medium stocking rate, produced better average daily liveweight gains than those on the corresponding 'cattle only' treatment. When liveweight gains during each month of the grazing season were studied, it was apparent that the cattle on both systems gained at a similar rate until early July. After that time, the mixed grazed cattle continued to grow at the same rate whilst the 'cattle only' group suffered a depression in daily liveweight gain. It was this July depression, in growth rate, that accounted for the differences in liveweight production per acre.

Table 1 also shows a slight liveweight gain advantage for lambs produced in mixed grazing systems. This was far greater when translated into financial terms since the lambs fattened more rapidly and hence could be marketed earlier at high prices. Possibly more important than this was the fact that 96 per cent of the lambs on the mixed grazing treatment at the high level of stocking were sold fat over the three-year trial period, compared with 70–88 per cent from the corresponding 'sheep only' system.

System studies 1971-72

As a result of the above work, which was carried out on small experimental plots, two farmlets were established in spring 1971 on land that had previously been used for intensive mixed grazing experiments. One farmlet is a beef fattening system with sheep as the secondary animal, on the other a fat lamb producing system with beef cattle as the secondary animal. On the beef-sheep system the stocking rate is two spring-born fattening beasts and two Welsh Halfbred ewes with their lambs per acre. The stocking rate of the sheep-beef system is six Welsh Halfbred ewes with lambs and one six month old autumn born suckler calf.

Beef-sheep farmlet

Twenty acres of six year old perennial ryegrass ley were divided into eight paddocks. These support forty cattle from suckled calf to finishing and forty ewes producing fat lambs.

The stock consisted of spring-born calves of both sexes purchased in the autumn, mainly from the suckler herd. They were crosses between Hereford and South Devon bulls with Friesian and Hereford × Friesian cows. The ewes (20 per cent ewe lambs) were Halfbred type which were put to a Dorset Down ram.

The weaned calves were housed cheaply in the autumn and fed silage with barley supplement until turn-out in the following spring. The ewes were outwintered, three paddocks being retained for lambing and given an early N application. After lambing in early March, a low level of high magnesium concentrate was fed for a short period to prevent hypomagnesaemia. The remaining five paddocks were then dressed with N and reserved for the cattle which were turned out six weeks later, when the rotational grazing of the paddocks commenced.

The cattle, being the major enterprise, were given grazing priority throughout. They were grazed half a paddock ahead of the ewes early in the season,

the latter serving to use grass rejected by the cattle. As the season progressed, the ewes and lambs were moved a full paddock behind the cattle to cope with the increased herbage rejection. Surplus grass was conserved, five acres being cut in the spring and another five in the autumn to feed the next intake of calves in winter. If N applications had not been discontinued in mid-season, further autumn conservation could have been made.

A high proportion of the cattle were sold fat in July and August, after which supplementary cereal feeding was started to help finish the remaining cattle. All but one animal was sold fat by early November. The lambs were weaned in mid-July on to the aftermaths of the first hay cut. At this stage the first fat lambs were marketed. The remainder were finished on one paddock which was not grazed by cattle. The ewes were confined to one paddock until flushing to counteract a tendency to over-fatness.

Nitrogen use averaged 228 units per acre, sixty being applied in the first dressing and thirty after each grazing until mid-season. Conservation areas received a 25 : 10 : 10 compound. Basic slag is applied every three years.

The cattle were dosed against stomach worms early in July and at the end of August. The ewes were dosed before entering the lambing paddocks. The lambs were dosed for nematodirus, then against stomach worms at weaning.

In 1971 the output from these 20 acres was 40 fat cattle and 48 fat lambs. In 1972 it was 37 fat cattle and 64 fat lambs.

Sheep-beef farmlet

Thirty acres of older ley were divided into eight paddocks and stocked with 180 ewes producing fat lambs and thirty weaned autumn born suckler calves. The ewes (20 per cent ewe lambs) were all Halfbred type. Ewe lambs were away-wintered and crossed with a South Down ram, while a Dorset Down ram gave an early fattening type of lamb from the ewes. The cattle were all Friesian and Hereford × (Hereford × Friesian) purchased at weaning in spring, mainly from the autumn calving suckler herd.

The ewes were housed in purpose-built sheds during the winter, and supplementary concentrate feeding started six to eight weeks before lambing. After lambing, the ewes were turned on to the paddocks. In spite of an early nitrogen application, grass shortage may be critical at this time and lambing in late March with supplementary feeding for a further month is considered essential. After grazing most of the area until late April, the ewes started rotational grazing and were then joined by the cattle in early May.

Three paddocks were conserved as hay for winter feeding the ewes, then the aftermaths were set stocked by lambs after weaning, being taken back into the rotation as the lambs were sold. The ewes were confined to two unfertilized paddocks between weaning and flushing. The autumn born suckler calves were purchased from the hill herd after weaning in spring when they weighed between four and four and a half cwt. They grazed with the ewes and lambs until the latter were weaned and then grazed the three remaining paddocks on a twenty-one day cycle. They were gradually introduced to an intensive fattening regime in order to finish them in early winter. In 1971 nineteen beasts were sold fat off grass by early November and the rest were yarded and put on to a high cereal diet. All had been sold fat by mid-February. The nineteen sold fat off grass were rather light but had to be sold because of a temporary shortage of yarding facilities. Therefore, in that

year the output from these 30 acres was 29 cattle and 210 fat lambs. In 1972 it was 30 cattle and 246 fat lambs.

Table 2

Summary of farmlet output results

	1971	1972
30 acre farmlet (Sheep-beef)		
Lambs	210	246
Cattle	29	30
20 acre farmlet (Beef-sheep)		
Cattle	40	37
Lambs	48	64

Conclusions

The principle of mixed grazing operated successfully in its own right and showed possibilities for integration into many livestock systems.

As an adjunct to the hill farm, it will be appreciated that a relatively small area of lowland or improved marginal land (stocking rate can be varied according to the quality of the land) is required to carry the output of the hill through to slaughter, thus avoiding the expense and risk of the store market. The beef-sheep farmlet confirmed itself essentially as a cattle fattening system, high liveweight gains being the feature of the spring grass flush. This is followed by a dilution of stocking rate as sales start in mid-season, so matching the falling growth and quality of the grass and leaving to the ewes the surplus autumn and winter herbage.

The sheep-beef farmlet was equally successful as a lamb fattening system and showed potential for being incorporated in to overall farming systems. The role of the cattle requires careful consideration. The spring grass, most suitable for fattening, is required by the lambs. Since they are the major enterprise, it is important that they are not subject to competition from the cattle before being weaned on to the aftermaths; hence the decision to use the smaller autumn born calf. This means that there is only a surplus of grass when lamb sales start after midsummer, and such grass is not of high fattening potential. Thus the sheep-beef system is essentially a store-producing enterprise. While many of the cattle were successfully fattened, a more viable alternative may be to increase the number of cattle and be content with less finish. This would open the way to intensively finishing the cattle during the winter, or over-wintering them as stores to be finished at heavy weights in the following spring.

An equally viable alternative would be integration with a dairy heifer rearing enterprise where spring calving heifers spend their second grazing season on the system.

N. G. Lawrence, B.Sc. (Hons), Dip. Agric. Ext., is stationed at Trawscoed Experimental Husbandry Farm.

Early Potatoes in West Cornwall

N. J. Hurford

EARLY potatoes have been grown commercially in West Cornwall since about 1740. Old leys were preferred, dug by hand with a fine tilth obtained by the 'dexterous hand of the workmen'. The setts were then placed in a drill formed by the use of a long-handled Cornish shovel, each planted drill being covered by the turning of the next furrow by the shovel. This gave a between-row spacing of approximately 11 inches. The whole area might then be covered with seaweed. It was better still to place rotten stable manure between the earth and the seaweed.

Favourable, sheltered sites on the south facing cliffs were chosen and fields were often no larger than an average-sized living room. Mechanization of the early potato crop has been responsible for their decline, and the few still seen today between Lamorna and Lands End are now only of historic importance. Fields in the far west are still small, rarely more than 5 acres; but with the increasing use of larger and faster machines, particularly planters, a few are now of 50 or more acres.

The earliest production is centred along the sheltered areas of the coastal belt from the Lizard to Porthgwarra, south of Lands End, but the bulk of the crop is found growing to the west of Hayle and around Mount's Bay. Favourable sites near Newquay, Truro and as far east as the Tamar Valley also grow early potatoes, but here lifting is two or three weeks later.

Choice of site

The choice of site for early production is just as important in Cornwall as anywhere else; in fact, even more so, because the high cost of transport to distant markets is made economically viable only by the higher early returns. The ideal is a south facing field of well-drained sandy loam relatively stone free and sheltered from the salty south-westerly gales which will damage foliage, yet not part of a valley bottom frost pocket. It must be large enough to enable planting and harvesting machinery to be used efficiently.

Steep sloping fields can be used successfully even though drainage may be excessive. Using crawler tractors, a holding with slopes of one in three has dug potatoes on a field scale by the 1st of May, comparing favourably with Jersey or the Scilly Isles.

The undulating topography greatly reduces the acreage which can be classed as ideal. Rotating the crops around the farm is practised almost everywhere and in fact is considered a good husbandry technique, but the reasons for it need not apply to the main Cornish crops of potatoes and broccoli.

Where early potatoes are the main crop of a holding and grown repeatedly in the same fields, yields are not reduced by eelworm. It is thought that the immature eelworms are released from the cysts just before lifting the crop and perish because there is no growing host plant to live on. The ground-keepers (tubers remaining in the ground after harvesting) do not produce growth for four to six weeks, so they do not encourage a build-up of eelworm.

All growers like to break some old pasture as this gives a well-structured soil, easy to work even when conditions are not ideal. Often potatoes follow winter crops such as broccoli, spring greens or kale and then ploughing is not done until January. The soil is by then pouched (during the harvest of the previous crop) and difficult to work to a good tilth by planting time.

Soil condition

Planting must be done when the soil is in the right condition, a fact recognized by all growers. Rainfall during the planting season can be high; this year it was nearly twice the average with 19·65 inches between January to March. So, with often less than a week between periods of rain, it is essential that the soil is in good heart and as near ready for planting before January as possible. This is achieved by autumn ploughing and ridging the ground for extra drainage. Cornish growers cannot rely on winter frost to create a tilth on structureless soil. Crumb structure can only be maintained by ploughing early in the autumn under dry conditions, leaving time for repeated wetting and drying of the soil to break up the clods.

Potatoes are grown on a range of soil types. West of Penzance is a granite-based sandy loam, the lower-lying fields between Marazion and Hayle are a fine sandy loam, and east of Hayle is the Devonian series, less easy to work under difficult conditions. In the older growing areas, the heavy applications of sand and seaweed over the years has completely changed the soil types. Traditionally, calcareous seasand is used instead of limestone to correct acidity.

Manure is applied before ploughing, but because the cattle can remain outside for much of the year supplies are limited and rates vary from 2½—20 tons per acre. The organic matter levels remain high due to the grass leys used, which also reduces soil erosion on the steep slopes.

Most growers use a 1 : 1½ : 1 fertilizer to supply 100–120 units of nitrogen. Investigation has shown a tendency to apply too much fertilizer to the crop. Little account is taken of previous crop residues, manure applied, method of fertilizer application or the fertility of individual fields. The possible loss to the grower is difficult to calculate, but excess nitrogen or potash will delay the digging at a time when prices may drop £40 per ton a week. The average surplus was 28 units N, 47 units P, 61 units K per acre, with some growers applying surplus fertilizer valued at £18 per acre each year.

Seed

The seed is normally obtained from Scotland or Ireland although many growers save some of their own. Distance from the traditional seed growing areas affects the control a ware grower has over seed quality; the closer the seed is grown to the production area, the easier will be liaison between the seed and ware producer to ensure correct preparation and uniformity of the

sample. Thus, local contact between seed growers in North Cornwall and ware producers in West Cornwall is an ideal arrangement. Source of seed has little bearing on the earliness or yield, but the way in which the seed crop was grown and treated has a considerable effect on final profitability.

To be sure that seed is at the correct physiological stage at planting time the 'seed crop' should be planted in April, the haulm burnt off in July and the crop lifted in August/September. Delivery to the ware producer should be early in the autumn so that the seed can be put into chitting trays before the shoots begin to grow. If the first chits are damaged, multi-sprouting (four or more shoots) occurs. Two or three chits per tuber are preferred as these produce fewer but larger tubers; multi-sprouted seed produces a similar yield made up of many small tubers which delay harvest until they are of a saleable size. The main variety 'Home Guard' breaks dormancy early, so growers take delivery of seed in October where possible.

The seed lifting date is important. A ware crop from August/September lifted seed will be ready earlier than that lifted in October/November. Added to this is the bonus that early lifted seed is less affected by gangrene, a low temperature disease (see Table). The higher air temperatures at the earlier lifting quickly heals damaged tubers and reduces the spread of infection. Gangrene has been known to affect 55 per cent of a seed sample, and since seed accounts for more than one-third of the total growing costs of £120–150 per acre, the loss can be considerable.

Table

Gangrene infection of seed by mid-December

Date lifted	Gangrene infection (%)
Late August	3·9
1–15 September	4·6
16–30 September	15·0
1–15 October	21·0

Seed with certificate 'A' and 'SS' is bought to be sure that the stock is free from eelworm and virus. The riddle size grading 1¼–2¼ inches these days is too wide a range. With the variety Home Guard the large seed (2¼ in.) will produce a bolder sample earlier compared with the small 1¼ in. seed, so the more progressive grower now regrades seed into two or three sizes. There is the added advantage that with the faster belt type planter a more uniform plant spacing is obtained by regraded seed.

A recent study showed that there was no relationship between the price of seed and its quality. Often growers would pay more attention to getting seed at a low price rather than to quality. In many cases the cheapest seed was that of best quality which was delivered early.

Seed is placed in chitting trays within a few weeks of delivery. The traditional chitting area was in the loft of cattle barns with the idea that the heat from the animals was sufficient to prevent frost damage. Due to the mild climate, however, frost is seldom a problem during chitting. The real difficulty is holding back the chit length during mild spells, especially if planting is delayed by wet weather. The old sheds have many disadvantages, i.e., poor natural light, access often by steps, poor ventilation and lack of height.

Recently growers have erected purpose-built chitting houses to improve the chitting environment and reduce handling costs. These are able to house seed for up to 200 acres and have 50 per cent ventilation of the walls, good stacking height and good access enabling pallet handling machinery to be used (essential for fast planting machinery).

Planting

Planting is done during dry spells between January and March at speeds of one to ten acres a day. On the small farms it is a job done by the family, fitted in between milking times. Belt type planters are used to plant large acreages at the rate of one acre per hour, although spacing may be uneven. The earliest sites which are ridged in the autumn are planted by placing seed in the furrows by hand and covered by splitting back the ridge.

Placing seed by hand

A seed rate of 30 cwt per acre is achieved by most, with some aiming at up to 45 cwt. Early plantings are at a greater depth for frost protection; later, the seed is placed as shallow as possible to be sure of a quick emergence.

Weed control is no problem since all growers use a linuron plus paraquat mixture at 0–10 per cent crop emergence. Generally blight is not a problem to the early ware crop, but in the extreme west some growers spray as a precaution.

With an annual rainfall of 41 in. per year many consider irrigation unnecessary and too heavy a capital investment to justify its use, particularly since there is no other crop on which it can be used economically. Weather records show, however, that in the main production areas the soil moisture deficit is constantly around 3 in. during the growing season of the crop. Trials at Rosewarne E.H.S. indicate a good response to irrigation at 1 in. SMD and that the crop would benefit six years out of ten.

Lifting

Digging starts in mid-May at three tons per acre with the price around £125 per ton. This drops rapidly as the yields increase to ten tons per acre by mid-June when returns are down to about £25 per ton. The crop is cleared by late June unless prices have been low due to a clash with earlies grown in Kent or Lincolnshire. The most common method of harvesting is to lift with a chain elevator digger and pick up off the ground, grading as you go as there is still sufficient labour willing to do this. The complete harvesters are unable to cope with the stones which badly skin the immature tubers.

Marketing is in 28 and 56 lb bags either to local wholesalers or direct by road to markets throughout England.

Key to success

The successful growing of early potatoes in West Cornwall depends upon three factors—site, soil and seed; but if attention is not paid to detail, the two weeks' advantage afforded by the climatic conditions there will be lost.

N. J. Hurford, N.D.H., is a Horticultural Advisory Officer with A.D.A.S. at Guildford.

Joint Consultative Organization on Research and Development

The Agricultural Research Council, the Ministry of Agriculture, Fisheries and Food, and the Department of Agriculture and Fisheries for Scotland are to set up jointly a consultative organization to advise them on programmes and priorities for government-financed research and development in food and agriculture.

The organization will consist of five Boards covering Animals; Arable Crops and Forage; Horticulture; Food Safety, Nutrition and Technology; and Engineering and Structures. Each Board's field will extend from the production of the basic product to the sale of the final product.

The consultative organization will be made up of a balanced membership drawn from several interests concerned with research and development in food and agriculture. These will include scientists, members of the food and agricultural industries, and representatives of the policy, scientific and technical sections of the two Departments. The economic voice will also be represented.

Each Board will be responsible for setting up a number of Committees, as it deems necessary. Most of these will be set up on a commodity basis but research with general application in e.g., animal, plant and soil science, will need to be dealt with by suitable, specialist Committees. It will be for the Boards themselves to decide what Committees are actually appointed. Committees will be responsible for reviewing in detail research and development within their particular fields, for assessing priorities or recommending the modification or termination of existing projects, and it will be at Committee level that individual proposals will be considered in depth.

The main tasks of each Board will be to consider priorities between proposals received from various Committees reporting to it, to express views on the general balance of research and development programmes within its field and to make recommendations regarding the implementation of priority proposals. Additional functions will be to keep under review the progress of current projects; in the light of other developments and of other proposed projects to suggest areas where existing research and development might be modified or terminated; and generally to consider long-term broad research and development strategy.

The Scottish Agricultural Development Council, which is responsible for planning and co-ordinating agricultural development work in Scotland, will work closely with the new organization and will have a firm organizational link with it.

The consultative organization will replace the Agricultural Research Council's standing and technical committee structure. The Council and the Departments are putting in hand the work of setting it up. Research and equipment grants made to universities by the Council will continue to be handled through its independent committee arrangements.

Group of steers being fed a poultry waste/barley ration

EXPERIMENTAL HUSBANDRY FARMS

Dried Poultry Waste and Intensive Beef

J. M. Oliphant

Since about 1968 there has been a marked loss of enthusiasm among intensive beef producers due to declining profits. Although returns during this period have increased by about 30 per cent, they have been more than off-set by the increase in calf prices, concentrate feeds and other variable costs resulting in a substantial fall in gross margins. One means of combating this trend is the use in the ration of cheaper forms of feedingstuff and, in particular, the substitution of the more expensive protein constituents by other forms of feed. One which has proved eminently suitable in trials at Boxworth Experimental Husbandry Farm as well as elsewhere is dried poultry waste.

Waste disposal is a major factor in the management of all livestock enterprises, more particularly since they have become intensified into more economic large-scale units. In no other livestock industry is this more so than in the poultry industry; the national output of manure has been estimated to be in the region of two million tons per annum and production units often have insufficient land for disposal by spreading. Drying the material facilitates its handling and storage and produces a saleable product, but the cost cannot be met if it is valued in terms of fertilizer plant nutrients except in very special cases. However, if it is regarded as an animal feedingstuff, processing costs can be more than offset at current prices. Used in this way there is also less danger of pollution of the environment, a danger which should be constantly kept in mind.

Background

The use of poultry waste as an animal feedingstuff was first reported in the U.S.A. as far back as 1954. Research work on the many aspects of the subject has since been taken up by other workers and put into practical use in many other parts of the world. In Britain some analytical work coupled with small scale feeding trials took place in 1968 to see what differences, if any there are between the types of material available in this country. This was a joint operation between the University College of Wales at Bangor and the local Nutrition Chemistry Department of the Ministry of Agriculture. Since then, larger scale feeding trials have been carried out at several of the Ministry's Experimental Husbandry Farms and at other centres, the main Ministry investigations being at Drayton E.H.F. (1969 only) and Boxworth E.H.F. (1969 to 1971).

The material

Dried poultry waste is very variable in composition, depending on the type of poultry enterprise in which it originates as well as the management to which both the poultry and the material have been subjected. Generally, waste which comes from egg production batteries is higher in crude protein and lower in fibre than is material from deep litter houses because of the admixture of litter material in the latter. However, some degree of standardization may be attained by obtaining the material from a single source.

The crude protein value is dependent on the presence of non-protein nitrogenous compounds, only 20–30 per cent of the total nitrogen being in the form of true protein. The most important of these compounds is uric acid which, like urea, is utilized via rumen micro-organisms. This substance has not only been demonstrated to be suitable to be used by the organisms but to be superior to urea in this respect because it is less soluble, becomes more slowly available and is therefore less susceptible to loss.

Dried poultry waste is a rich source of minerals and, when mixed in a ration, supplies those elements necessary for animal growth and health. This property provides some additional economy in that it renders the need for a mineral supplement to the ration unnecessary. The possible exception to this is sodium which has sometimes been found to be present in quantities well below the accepted standards for intake. This deficiency can be remedied by the provision of a salt lick.

One possible objection to the use of this material as animal feed is the fear that it may contain organisms capable of causing animal disease. If this did

occur widespread outbreaks of disease could be anticipated on farm premises remote from the source of the poultry waste. This possibility has been examined and provided that the material has been adequately dried at a high temperature there is very little danger in this respect.

Other possible dangers could be the involuntary intake of antibiotics by humans or copper toxicity in the animals, since either antibiotics or copper may have been used in the feed at the poultry source. Again, analysis has shown such fears to be groundless. Only minute traces of antibiotics have been found in the many samples analysed; and copper, although it can be present in the pure material in quantities that might be toxic to young lambs, is not in sufficient concentration to be a danger to cattle. Livers from slaughtered beasts have not shown any concentration of copper outside the normal range. A third objection might be the possibility of taint in the meat, but full scale tasting trials carried out at the Meat Research Institute on samples of beef from the trial animals have shown no detectable differences.

Experimental work

Following on the basic analytical work at Bangor, a feeding trial was initiated in 1969 at the Experimental Husbandry Farms mentioned earlier to study the implications of feeding the material under farm conditions. Autumn born Friesian steers were used and the feeding treatments were:

(*a*) A 'Rowett' type control in which the protein constituents were soya and fish meals.

(*b*) Soya and fish meals replaced by dried poultry waste on an equal crude protein basis.

(*c*) Half the soya and fish meal replaced by dried poultry waste.

All the rations were calculated to contain 14·5 per cent crude protein. Results from the first year were very similar at both Drayton and Boxworth in that the liveweight gains as a result of ration (*b*) fell by about 0·5 lb per day as compared with animals on the control ration. There was some increase in the margin over cost of calf and concentrate at Boxworth, but on both farms beasts took about fifty days longer to fatten.

The reason for this rather poor initial result is not hard to find. The energy value of poultry waste has not yet been established with any accuracy but is certainly low and for the practical purpose of making up rations may be disregarded. In 1969 the dried poultry waste used in the trial had a crude protein of 24 per cent. To bring the mixture with barley up to the required standard of 14·5 per cent crude protein entailed its inclusion in the mix at the rate of 5½ cwt to the ton (28 per cent). Thus there was a substantial displacement of barley and loss of energy from the mix. This conclusion was substantiated by the fact that the animals in whose ration only half the protein constituents had been replaced (14 per cent poultry waste in the mix) had liveweight gains which were approximately halfway between those of the control and the all-poultry-waste animals. In that year the material under trial came from deep litter houses and had a crude fibre content of 25 per cent which provided a built-in energy requirement.

In 1970 deep litter waste (DLPW) with a crude protein content of 31 per cent was obtained and an additional treatment was included in the trial. This consisted of battery poultry waste (BPW) of 32 per cent crude protein.

These materials were mixed with barley at rates of 19 and 18 per cent of the mix respectively. These proportions gave adequate performance in the animals compared with the control as is shown in the following table of results:

	Control	DLPW	½DLPW	BPW
Weight at start (lb)	358	355	362	360
Weight at slaughter (lb)	875	889	876	885
Days on trial	190	210	201	206
Daily liveweight gain (lb)	2·75	2·54	2·57	2·58
Carcase weight (lb)	479	481	468	475
Grade	A	A—	A—	A—
Total concentrates (cwt)	27·9	30·0	29·6	30·0
Conversion	5·54	5·77	5·89	5·76

Use of these materials in the rations resulted in an increased margin over cost of calf and concentrates compared with the control amounting to £6·40 for deep litter and £5 for battery poultry waste.

In 1971, the last year of the trial, both types of poultry waste were included in their respective mixes at the rate of 3½ cwt per ton, 18 per cent of the ration, irrespective of their crude protein analyses. The treatment rations were then brought up to the 14·5 per cent crude protein standard by the addition of a few pounds of urea to each mix depending on the analysis of the batch in current use. This appeared to work very well and satisfactory results were again obtained with similar increases in the margin per beast as in the previous year. It also demonstrated how a standard crude protein product could be produced by the processor.

Conclusions

The results of this experiment show that there is great potential in the use of poultry waste for fattening steers, especially when it has been efficiently processed. Steers readily ate the rations containing it even when there was an abrupt changeover of the ration. They always looked well and there was no evidence of any digestive upset. Of the ninety-six animals which went through the trial at Boxworth only one case of bloat was recorded. At the current price of £16 per ton a substantial saving in feed cost can be obtained.

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Growing Cereals for Seed

In view of the results from a survey of cereal seed in drills published by the Weed Research Organization farmers are urged to take particular note of the advice given in a new leaflet about cereal seed production issued by the National Institute of Agricultural Botany. It is entitled 'Growing Cereals for Seed' and copies are available from N.I.A.B., Huntingdon Road, Cambridge, price 7p (including postage).

Results of the survey showed a high contamination of wild oat seeds, together with a wide range of other weed seeds, in seed saved on the farm.

Farmers are advised to attempt to grow their own seed only if they can exercise close supervision and can observe the precautions described in the leaflet.

Before You Sign —

An Analysis of Contracts

P. R. J. Ellis

NEXT month the U.K. will become a full member of the E.E.C. which will mean a complete change in marketing arrangements for the farmers. The price support of deficiency payments will be phased out. In its place could be an assured contract outlet, an assured contract price, a feedback of information on consumer preference and greater availability of capital.

The Government set up an independent committee to review the present situation and to make recommendations on how marketing of produce in the U.K. might be improved. The Barker Report (Cmnd 5099) provides statistics for the first time about the number of written contracts in existence for different commodities. The three main findings of the report were that:

1. there is scope for more contract farming;
2. encouragement is required for more horizontal grouping of producers;
3. there is an urgent need for a co-ordinating body spanning agricultural production and marketing.

The Committee saw merits in contract farming and, as stated in the Green Paper on marketing (Cmnd 5121), the Government has accepted the Committee's judgement.

Understanding the Contract

Signing a contract for many farmers is a rare occurrence. It is hardly surprising that mistakes are made, not least by forgetting to read the 'small print'. This has resulted in the past in some farmers getting into difficulties.

Before signing a contract there are a number of questions which the farmer should ask himself about the terms of the contract and the document itself. This should help crystallize the farmer's own objectives as well as making it easier to compare the terms with non-contract opportunities. Once the farmer is clear in his own mind what he wants from a contract it is advisable to consult experts about the specific contract selected. There are many sources of help; among them are the NFU contract vetting service, the Central Council for Agricultural and Horticultural Co-operation (CCAHC) and private consultants.

It is hoped the following analysis of contracts will act as a useful starting point.

Terms of the Contract

Price. Price is nearly always one of the first items that a farmer looks at. But should the farmer's objective always be the highest possible price to the

exclusion of all else? Here the farmer may wish to consider:

possible long term gains;

any advantage of slightly lower price with a guaranteed outlet.

For certain commodities a quality premium may be offered, and under these circumstances any comparison should be made on the basis of the net return.

It may also be useful if the maximum financial liability of each party is clearly stated.

Services Required of Producer. One requirement of a contract which may have a considerable bearing on the producer's costs is whether or not any post harvesting services have to be carried out by him. Examples of such services are the washing and prepacking of carrots or potatoes.

Services Provided by the Buyer. A buyer of produce may provide certain services, such as transport, insurance, technical expertise and/or capital. Where this is done the farmer should ask himself whether the services are really needed; whether they could be provided better in some other way; and what these services cost.

A point which is often ignored is that where technical advice is provided little or no provision may be made to protect the farmer against faulty advice.

Quantity. Contracts differ in the way in which the quantities required are specified, i.e., tons or acreage of the crop. As this may affect the farmer's ability to produce the required quantity in the specified time it is important to be clear which units are being used. Where tons are the units specified, the farmer should be clear what risk he will have to carry when yields are below the normal. Where yields are prone to wide fluctuations it might be an advantage to select a contract where acreage is the unit specified. But a contract specifying tons might have the advantage that land could be released either for growing more of the same crop or for another crop. This could be pertinent for blackcurrants where the contract is usually for 8–10 years.

A problem which may arise when the contract is for only a proportion of the production is to find a suitable outlet for the remainder.

The quantity of produce can easily be defined, but this is not yet so for the quality of all commodities. To avoid later misinterpretations, *objective* criteria should be used where possible—perhaps by references to some unbiased arbitrator.

The Document itself

Wording. To avoid disputes, the wording of a contract must make it clear what is being offered and what is being accepted, e.g., what quality tomatoes the farmer will deliver.

However, the wording should not be too precise and try to cover all possibilities as, by so doing, one contingency is most likely to be omitted. A precise approach might also encourage the other party to search for loopholes.

In the event of court action simple wording enables a quick decision to be made.

Time Limits. The time for the contract to be completed should be clearly stated, although this might be extended under certain circumstances, such as adverse weather conditions.

Legally, a party may claim damages when the time limit is exceeded without agreement.

Escape Clause. In all agricultural production the farmer has to contend with nature. It is advisable to accept that there should be an escape clause to protect the farmer in the event of pestilence, war, death and/or act of God.

Arbitration. Contracts seldom include an arbitration clause but it can be helpful. Such a clause may name a mutually agreed arbitrator or an organization which would appoint an arbitrator. Arbitration can be very important at a time of over production.

Conclusions

When looking at contracts the farmer should always consider what *his* objectives are and how far the terms of the contracts meet those objectives.

The points made above may be used as a guide but advice should be sought from experts such as N.F.U. legal department; CCAHC and private consultants.

When signing a contract, a farmer should remember that it should be to the *mutual* advantage of the buyer and himself, not solely to his benefit.

Check List

A. *Terms of the Contract*	B. *The Document itself*
(i) Price	(i) Wording
(ii) Service required of producer	(ii) Time Limits
(iii) Services provided by the buyer	(iii) Escape clause
(iv) Quantity	(iv) Arbitration

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Isolation Boxes for Cattle

Last month's issue of *Agriculture* included an article by Michael Haywood on the construction of isolation boxes.

It should be borne in mind when designing isolation boxes that, besides securing an animal for examination or testing, it may also be necessary to lift a recumbent animal. Providing the means by which this may be done—for example, a strong beam or strong rings in the roof construction—should be considered.

Also, as regards drainage and the disposal of used bedding it should be remembered that the Brucella organism outside the animal body has been known to survive in slurry for up to twelve weeks. The need, therefore, for extreme care to prevent contamination cannot be over-emphasized.

Farm Buildings: What Do We Possess?

Berkeley Hill

FARMERS and landlords spend very considerable sums every year on new buildings and making alterations to existing ones. Indeed, since 1968 they have spent more on buildings and works (drainage, roads, etc.) than on plant and machinery, a situation unknown since official statistics on investment were first issued in 1948. In 1970, the amount spent on buildings and works in Britain was £114 million, and 1971 shows an even higher figure—£139 million. This represents, in 1970, 19 per cent of farming's net income. Yet we know very little of what there is to show for the investment by this and earlier generations of farmers—our stock of farm buildings. We do not know how this stock is made up in terms of age, how it is used, or how it is distributed between farms of different types, tenures and sizes. Perhaps most important, we do not know how suitable much of it is to present-day farming methods and how it limits farmers in their choice and scale of enterprises. This will have particular significance when British farming wishes to adjust to E.E.C. conditions over the next five years or so.

Survey in Berkshire

In order to find out more about farm buildings the writer undertook a survey of seventy farms in Berkshire. Although this is a relatively small number and covered only one county it has provided results of considerable significance*, which are discussed below. More recently, the Ministry of Agriculture commissioned a wider study from Wye College, covering one thousand farms in England and Wales. This comprehensive study will provide an up-to-date inventory of the stock of farm buildings (including grain stores) in England and Wales. It will show the distribution of the buildings by age, use, change in use since 1959/61, unused potential, physical characteristics, farm type (economic classification, size and tenure) and economic life.

Age distribution

The major way of measuring buildings in the Berkshire survey was in terms of their floor area. On this basis, buildings erected before the First World War contributed about a third of the total floor area, even if those

*The full results of the Berkshire survey are published in *Farm-Building Capital—an empirical study*. Berkeley Hill. Wye College, University of London, February 1972. Copies of the full report, price 15p, can be obtained from the Publications Office, School of Rural Economics and Related Studies, Wye College, Ashford, Kent.

not in use are discounted (see Table 1). Buildings put up since the introduction of the Farm Improvement Scheme (F.I.S.) until the end of 1968 (which was the end-point of the survey) contributed just over a third, leaving the balance of the floor area, between a quarter and a third, made up by buildings erected between 1915 and 1956.

Table 1

Percentage distribution of stock of buildings by age: Berkshire 1968*

Date of construction	Floor area	Floor area in use
Pre 1915	35·4	32·9
1915–44	15·0	14·5
1945–56	13·2	13·9
1957–68	36·4	38·7
	100·0	100·0

It is clear from these preliminary results that the F.I.S. has made a great impact on the quantity of buildings available to farming. In practice it seems rare that the addition of a new building necessitates the demolition of an old one, so many of the post-F.I.S. buildings are true increases in farming's resources. It is obvious that the design and working of a scheme such as the F.I.S., and now the Farm Capital Grant Scheme, must be carefully watched as they are capable of directing or mis-directing large funds.

Another point arising is that although buildings are written off in farm accounts over ten years, in practice they remain in use much longer. They may well, however, change use many times.

Distribution by use, and change in use

Eight per cent of the floor area of buildings found in Berkshire was not being used in any of the farm's production processes (Table 2),and pre-1915 buildings accounted for two-thirds of this. Only two per cent of buildings put up after 1957 was not in use. Undoubtedly many buildings are subject to some changes of use during their lives. This can be caused by technological or economic change, or even by a change of farmer to a man with different skills or interests. In long-term planning it would seem prudent to acknowledge that farming takes place in a dynamic environment and so a degree of use-flexibility should be built in to long-life structures. Overall, 41 per cent

Table 2

Percentage distribution of the building stock between different uses: Berkshire 1968*

Floor area	Not used	Dairy	Cattle	Pigs	Poultry	Grain	Hay/ Straw	Imple-ments	Other
All ages	8·3	15·9	19·0	7·5	3·9	12·8	19·4	7·9	5·3
1957–68	2·3	24·4	23·4	11·1	2·4	7·6	23·1	2·6	3·1

*Weighted by county distribution of holdings by size.

of the floor area was found to have changed use since erected (Table 3); this also applied to buildings erected since 1957 but to a reduced extent—13 per cent.

Table 3

Floor area of buildings where use has changed, as percentage of total floor area in each current use

Date of construction	Not used	Dairy	Cattle	Pigs	Poultry	Grain	Hay/ Straw	Imple-ments	Other	All uses
All dates	100·0	0·0	11·8	62·1	72·3	64·4	5·8	19·9	65·3	40·6
1957–68	100·0	0·0	0·0	26·8	25·6	37·5	0·0	0·0	22·4	13·4

Accommodation for dairy cows and other cattle was the dominant use of buildings in Berkshire and this also applied to the new, post-1957 buildings.

A surprising feature of the results is the importance of pre-1915 buildings in grain storage. They accounted for not far short of half the floor area. Almost two-thirds of the total grain-storage floor area had come from other uses, and this applied even to those buildings put up since 1957 where over a third of those being used for grain storage had started life in another guise.

It is commonly expected that, when Britain joins the E.E.C., the economic climate will shift in favour of cereal growing and the wider study now being undertaken by Wye College will provide an assessment of grain storage capacity which should assist in implementing the intervention arrangements under the Common Agricultural Policy.

Farm types, tenures and sizes

It was found that, on farms up to 500 acres, those which had a dairy herd possessed approximately twice the quantity of buildings per acre of farms without a herd. This difference is probably the result of genuine economic forces—a milking herd requires a farm to be equipped with more buildings than are demanded by a cereal and livestock system.

Of greater significance were the differences found between farms of different tenures. Owner-occupiers had over fifty per cent more total floor area than tenant farmers of equivalent size, and approximately three times the quantity of buildings constructed since the introduction of the F.I.S. The overwhelming contribution to the difference in total floor area of buildings between the two tenures was this post-1957 difference. These differences raise further important questions.

First, are the differences in stock of buildings reflected in farm profits? If they are not, one must question whether the present uneven distribution of farm buildings between farms of different tenures is desirable. Since much of the investment since 1957 has been grant-aided through the F.I.S., the workings of that scheme, or its successor the Farm Capital Grant Scheme, should be re-examined if they encourage owner-occupiers to invest more than landlords-plus-tenants. Has the F.I.S. performed a dis-service to the economy by encouraging over-investment by owner-occupiers so that their additional capital is earning only very low returns? Do owner-occupiers invest in buildings irrationally, and is the landlord and tenant system better at gauging the viability of additional farm buildings? These are important questions and clearly much more research is required before they can be answered,

such as the project being undertaken by Wye College at the Ministry's request.

Economies of scale are often cited when the general move to larger farms in Britain is commented on. The Berkshire survey suggests that, taking farm type and tenure into account, on farms of up to about 500 acres acreage and area of buildings are directly proportional, i.e., there are no economies of scale attributable to buildings; but above that size of farm, economies may be experienced. It must be stressed that this conclusion is based on a fairly small sample, and greater numbers of farms of more than 500 acres would be required to assess the extent of their scale economies. This is a point which Wye College's larger survey should be able to clarify.

Value of buildings

A farm's stock of buildings cannot be meaningfully valued by summing the original costs of individual structures, even if this were known in all cases, including the value of any farm labour used in their erection. First, building costs change over time, generally rising. Second, the values of some buildings bear no relationship to their costs because farming methods change; for example, a milking parlour is of little value to a farmer who has forsaken milk production. Third, changes in construction methods have occurred, and few farmers would replace old stone or brick buildings by identical structures if cheaper modern framed buildings would be adequate.

A building's value stems from the services it is capable of giving to farm production. The buildings on the farms visited in Berkshire were valued in terms of the cost of providing modern structures capable of providing the same facilities as the existing buildings for as long as the existing buildings were expected to endure. At the level of costs pertaining in 1968 this came to about £40 per acre, of which buildings erected 1957–68 accounted for £14. Owner-occupiers on farms of less than 500 acres had more than one and a half times the value of buildings on rented farms and, in terms of buildings erected 1957–68, possessed three times the value; but variation among owner-occupiers was considerable. Since the Berkshire survey was completed, costs have risen and farmers have further added to the buildings on their farms, so that the values for 1972 are likely to be considerably above their 1968 level.

Postscript

The results from Berkshire raised some important questions on the nature and distribution of our stock of farm buildings. However, it would be unwise to assume that the results from this one county apply without variation over the whole of England and Wales. This can be ascertained only by the larger study which Wye College will be undertaking over the next two years.

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Farm Buildings: Changes in value

Berkeley Hill

ACCORDING to official estimates, British farmers and landowners are currently spending more on new buildings than at any time since national estimates were first made in 1948. Buildings account for about two-thirds of the £114 million spent in 1970 on new buildings and works—termed 'gross capital formation' in these assets; in 1971 the figure increased to £139 million.

The pattern of investment in new buildings and works since 1948 is shown in Graph 1. Prices pertaining to 1958 are used throughout to avoid the distorting effect of inflation; the graph, therefore, shows real changes in the quantity of new buildings and works provided from year to year.

Investments in buildings and works fell a little after the War and continued at about the same level until 1958 when a spectacular increase occurred. This was triggered off by the introduction of the Farm Improvement Scheme in 1957. However, it is difficult to ascertain how much of this investment had been held back in anticipation of the Scheme and how much was investment that, without the Scheme, would not otherwise have occurred.

In the mid-1960s the rise in investment halted, but has since continued upwards, with the F.I.S. and other schemes being replaced by the Farm Capital Grant Scheme which is, in effect, similar. The cause of the kink in the upward movement in the mid-1960s is difficult to pin-point; farmers who had invested in the first few years of the F.I.S. may have needed to await the fruits of their initial investments before being able to embark on a second round. Credit squeezes no doubt also played their part. Whatever were the restricting factors, their effect was only temporary.

Investment and capital consumption

Sums spent by the farming industry on new buildings and works do not necessarily increase the value of the stock of these assets at its disposal. Part, and perhaps all, of the spending will be taken up in keeping the value of the capital assets at the existing level by offsetting aging, wear and tear and obsolescence which reduce the value of buildings and works. Only if gross capital formation exceeds the sum required to offset the fall in value of capital can true increases in the stock of capital (or *net* capital formation) be said to occur. This fall in value, viewed on a national scale, is termed capital consumption as it represents the value of buildings and works used up in the processes of farming in the course of a year.

There are two chief reasons for needing to know how much capital in the form of buildings and works is consumed by farming. The first has been touched on; it is highly desirable to know how much of the industry's annual

A wide span building in course of construction

investment in these assets is simply absorbed in keeping up the value of the nation's stock of them, and how much represents further capitalization. This in turn has implications for the measurement of improvements in productivity.

The second is that if capital is used up in the processes of farming it must be properly accounted for by an allowance in the industry's accounts in the Annual Review and Determination of Guarantees procedure. A change in the presentation, used first in the 1971 White Paper, has required the estimation of capital consumption (or depreciation) for the United Kingdom as a whole. Although not yet of critical importance, inaccuracies in estimating capital consumption could, in the future, result in errors in the estimates of agriculture's income which should be avoided.

Estimating capital consumption

Given that it is desirable to estimate capital consumption, attention can be given to how this can be accomplished. The value of a building is conventionally assumed to fall in equal instalments over its life; therefore, once the life of buildings is known it is possible to estimate the nation's consumption of farm building capital in any year by knowing investment in that and previous years. This process of calculation is called a 'perpetual inventory' method*. While we know how much has been invested annually since 1948, unfortunately we have little reliable knowledge of how long buildings last in productive use. Thus an important part of the information required to calculate consumption is lacking.

Some people would argue that ten years is the correct life to use, as this is the period over which the cost of a building can be written off against income for taxation purposes. Ten years also corresponds broadly to the longest planning horizon which farmers might use when assessing the viability of an investment. On the other hand, it is known that buildings and works continue in productive use well beyond ten years. To estimate the consumption of

*For a fuller description of the perpetual inventory method see Berkeley Hill, 'Capital consumption and net capital formation in U.K. agriculture—buildings and works.' *Journal of the Agricultural Economics Society*, Vol. XXIII No. 3, September 1972.

them on this life would overstate consumption, and hence understate the income of farming.

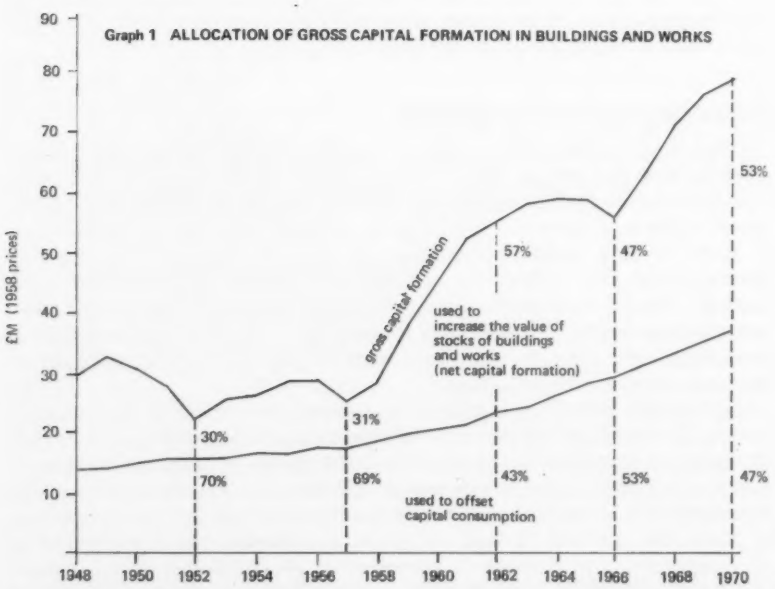
At the other extreme, it is known that the reasonable life expectancy of the major component of modern buildings which is probably the least durable —the asbestos/concrete roof or cladding—is 40 to 60 years. Yet to base consumption on a building life of, say, fifty years would ignore the fact that obsolescence, or at least a change to a less valued use, is likely to occur.

In reality, of course, different types of building have different lives; use, environment and standard of maintenance all have their effects. In the absence of more information, a life of thirty years for buildings and works would appear to be a sensible compromise. This is also the figure settled on by the Ministry of Agriculture and used in its estimates of depreciation which appear in the 1971 and 1972 Annual Review White Papers.

Capital consumption and net capital formation

In addition to gross capital formation (which is the total spending on new buildings and works) since 1948, the graph below also shows estimates of how this was split into replenishing the nation's stock of capital (i.e., offsetting capital consumption) and 'true' investment (net capital formation). This has required estimating annual expenditure by farming on assets between the Wars, and survey data was drawn on for this*.

Graph 1 ALLOCATION OF GROSS CAPITAL FORMATION IN BUILDINGS AND WORKS



*See footnote, p. 527.

It can be seen from the graph that the capital used up annually by agriculture in the form of buildings and works has increased steadily since the War; but the increase has been somewhat greater since the introduction of the Farm Improvement Scheme. On the basis of current investment trends, the upward movement of the annual consumption of buildings and works will continue; hence increasing sums will be required to offset it.

Margin between investment and consumption

If in a year a greater sum is invested in buildings and works than is used up by capital consumption, the value of these assets used by farming will increase, with, hopefully, beneficial effects on agricultural production. It can be seen from the graph that in every year since 1948 there has been an investment surplus over capital consumption, indicating a build-up of capital in farming over the period. However, the margin has not been uniform, and was particularly narrow between 1952 and 1957. During that period almost two-thirds of the investment was absorbed by capital consumption (see Table 1).

Table 1

Allocation of Gross Capital Formation

Year	Spending on new buildings and works (current prices) £m	Percentage taken up in offsetting fall in value of existing assets	Percentage representing increase in value of the assets used by farming
1948	21	47	53
1950	22	48	52
1952	20	70	30
1954	20	63	37
1956	27	62	38
1958	29	66	34
1960	45	47	53
1962	58	43	57
1964	65	45	55
1966	65	53	47
1968	87	47	53
1970	114	47	53

Source: 'Capital consumption and net capital formation in U.K. agriculture—buildings and works' (see footnote p. 527).

Since the introduction of the F.I.S., the surplus of investment over consumption has increased annually, except for the period 1962–6 when investment slackened. In 1970 just over half the investment by farmers in buildings and works represented true increases in the value of these assets in use, the remainder being offset by the fall in value of existing assets.

Capital consumption and farming income

For the purpose of calculating the income of British agriculture, the national farm is treated as tenanted. The depreciation of plant and machinery (capital consumption) is charged as a cost of farming against revenue, but the consumption of buildings and works is covered in the gross rent which is

charged for tenants and owner-occupiers alike. The two most recent White Papers (1971, 1972) have broken down this gross rent and, under the heading 'depreciation—other', included an estimate of the consumption of buildings and works.

Table 2 shows the estimated gross rent of the national farm together with estimates of capital consumption. It can be seen that capital consumption has been taking an increasing percentage of the gross rent in the years for which rent has been shown separately in the White Papers. In 1970 it absorbed a third of gross rent.

Table 2

Year	Gross rent of national farm* (a)	Capital consumption† (buildings and works) (b)	(b) as % of (a)
1967	134	37	28
1968	139	41	29
1969	147	46	31
1970	155	52	34

*Data from White Papers on the Annual Review and Determination of Guarantees converted to a calendar year basis.

†From 'Capital consumption and net capital formation in U.K. agriculture—buildings and works' (see footnote p. 527).

At present it is the level, not the composition, of the gross rent which is important in determining the estimated income of agriculture. However, the growth and dominance of owner-occupation is producing criticism of the convention by which all farms are treated as tenanted. If a change is made to treating the national farm as owner-occupied, the level of consumption of buildings and works will bear directly on the estimate of income. Thus the way it is calculated, especially the length of life chosen, will be of vital interest.

Postscript

It is clear that we need to know more accurately the rate at which farming uses up capital in the form of buildings and works. An important element in making estimates is the length of productive life of these assets. The Ministry of Agriculture has commissioned Wye College to undertake a survey of about one thousand farms in England and Wales; one object of this is to collect empirical evidence of the lives of buildings which should permit more accurate estimation of their consumption by agriculture.

Calves feeding from a pipeline

A method of feeding calves with

Milk Substitute by Pipeline

R. Pringle **W. Rutter**

SMALL calf-rearing enterprises can be a profitable sideline, and a system of rearing batches of about thirty beef calves to sell at any time after seven weeks of age has been practised for a number of years by Mr. Albert Howie of Touxhill, Auchnagatt in Aberdeenshire.

As in the rearing of all young animals, attention to detail is of utmost importance, but the margins between calf sale price and calf and food costs did not leave much room for high labour charges. A desire to reduce the time spent on feed preparation and bucket feeding created an interest in the possibility of some form of automatic feeding. But the capital costs of the various methods available were high and variable, depending on the degree of automation and the number of calves per group. It was also felt that if the

rearing enterprise was to remain successful, the ability to provide individual penning for at least the first ten days of the calf's stay on the farm must be maintained. This is useful in helping to control scour and salmonella infections to which bought-in calves are particularly prone; and even at older ages, it is still useful to be able to group the calves in batches of, say, six or eight.

Many of the proprietary automatic feeders which were available did not allow for individual penning. So Mr. Howie co-operated with the North of Scotland College of Agriculture in setting up a simple home-built pipeline system which would allow automatic feeding of cold milk substitute yet still provided individual or group penning if required.

Design of the system

The design requirements for the automatic cold milk system were that there should be one teat per calf and that the milk should be available throughout the twenty-four hours. It was also necessary to devise some means of periodically agitating the liquid in the pipeline to avoid the milk-fat globules settling out.

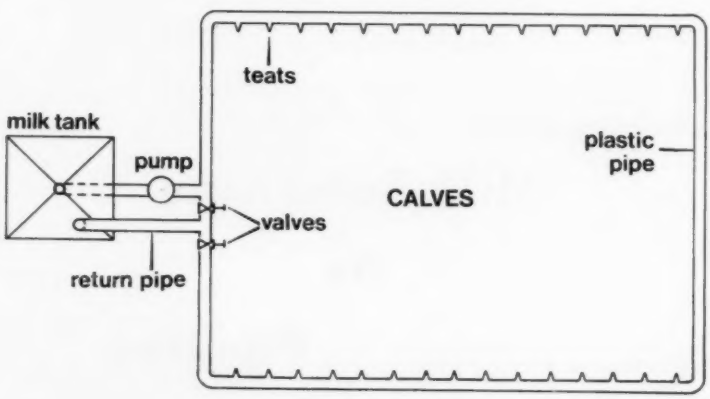


Fig. 1. Plan of pipeline layout

The system designed to meet these requirements is sketched in Fig. 1. The ring-main pipeline was such that, after insertion of pen divisions, the calves could be penned individually if required. The fibreglass milk storage tank (Plate 1) was mounted on a steel frame and the outlet pipe connected through an electric milk pump to piping fixed round the four walls of the calf pen, with the return pipe entering at the top of the tank. '*Rosemillar*' teats of the plunger valve type were attached vertically to the 40 in. high pipeline at equal intervals, the valves being screwed on to threaded T-pieces.

A special feature of the design was the incorporation of two diaphragm valves in the pipeline adjacent to the outlet and return pipes. Regulation of these valves allowed either full flow or short circuit flow of the liquid.

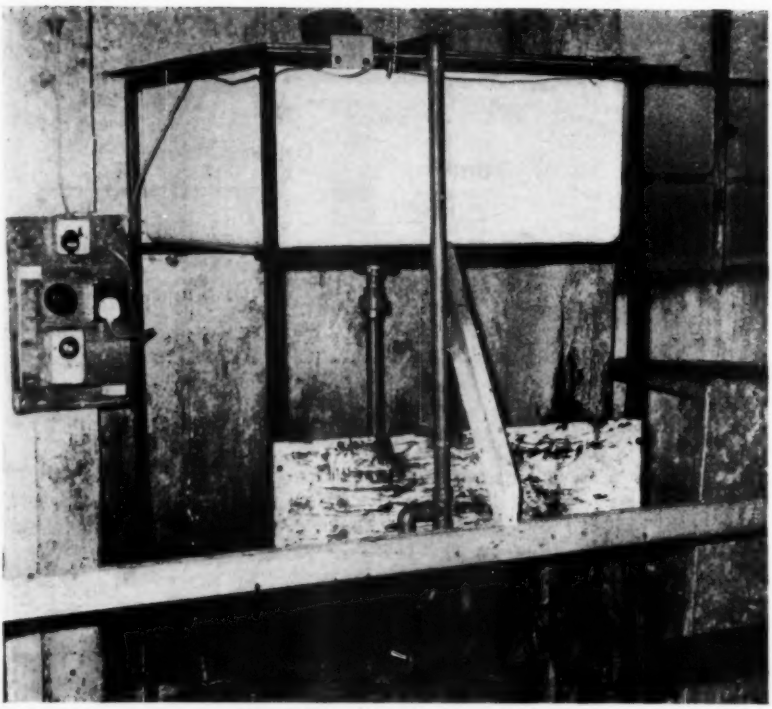


Plate 1. Fibreglass milk storage tank

The cost (1970 prices) of the equipment was:

	£
Piping and Diaphragm Valves	31
Sixty-gallon Tank	30
Steelwork	6
Switches and Control Board	9
Second-hand Releaser Jar Milk Pump	30
30 *Rosemillar* Teats at £1·36 each	41
Miscellaneous	2
	£149

In this case, use was made of a second-hand releaser jar pump: a new one would cost £105 at present prices but a cheaper type of pump with a smaller output should be available.

Operation

The tank is filled with cold water while the milk powder is mixed separately as a thick paste in a bucket. By closing one diaphragm valve and opening the other, the water in the tank is short circuited by the pump while the milk paste is added. As soon as mixing is complete, the short circuit valve is closed, the other opened and the pump put on to intermittent run by linking

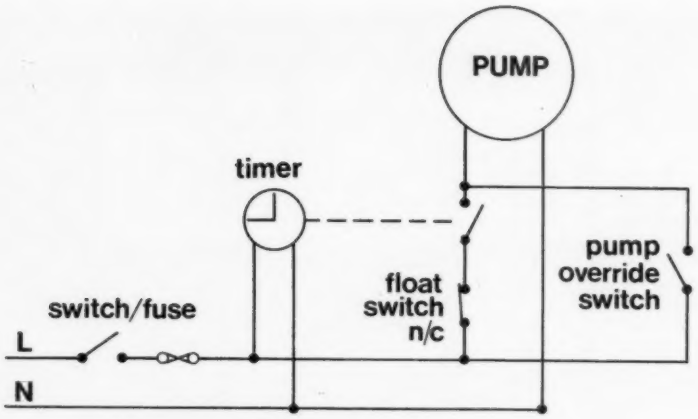


Fig. 2. Pump wiring circuit

it in series with a ten minute cycle timer (Fig. 2). This timer is set so that the pump runs for 30 seconds every 10 minutes. A float switch is connected in series with the pump to prevent it working if the tank runs dry.

The system is cleaned periodically by pumping first water and then a combined detergent sterilizer through the whole circuit. The teats are cleaned by squeezing each one in turn 5–6 times in the sterilizing solution and care is taken to ensure that the plunger valves are seating properly.

Calf performance

The most important part of the whole system is, of course, the performance of the calves and two separate batches have been recorded fully. The first consisted of thirty mainly Hereford × Friesian heifers purchased on 5th January 1971 at an average liveweight of 119 lb. They were introduced to cold milk substitute reconstituted from a 20 per cent fat milk powder (£7·50 per cwt) at an initial concentration of 8 oz per gallon. This was increased gradually to 14 oz per gallon. An 18 per cent crude protein concentrate (£2·75 per cwt), hay and water were freely available.

The calves were weaned at thirty-seven days when eating approximately 2¾ lb of creep daily. At this time rolled oats were introduced to the diet and gradually replaced a quarter of the creep feed. Towards the end of the rearing period, silage was offered and the calves were sold at sixty-seven days.

The second batch of calves, again Hereford × Friesian heifers but slightly younger and with a lower initial liveweight (107 lb), was treated exactly the same as the first batch except that oats were not used. One calf died a week after purchase.

Performance and costs for the two batches are given in the next Table. The costs are those actually incurred during the trial; they are likely to be different for other situations and times. No account has been taken of

		First batch Jan-Mar 1971	Second batch April-June 1971
Calves bought	No.	30	31
Calves sold	No.	30	30
Calf Liveweights (days fed)			
Start	lb	119	107
Weaning	lb	148 (37)	149 (32)
Sale	lb	205 (67)	161 (53)
Feed Consumption			
Milk Substitute	lb	32	33
Calf Creep	lb	176	183
Oats	lb	34	—
Financial Performance			
Increase in Calf Value	£	14·50	13·00
Milk and Concentrate Costs	£	7·00	6·79
Difference	£	7·50	6·21

veterinary, hay, silage and fixed costs, but presumably these would be the same as in a traditional calf rearing set-up with which the system might be compared.

R. Pringle, B.Sc., is on the staff at the North of Scotland College of Agriculture, Aberdeen, and **W. Rutter, B.Sc.,** is now on the staff of the Edinburgh School of Agriculture.

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Finding Out More About Tree Roots Survey Started by Kew

A survey into the rooting habits of common trees has been started at the Royal Botanic Gardens, Kew, where samples of tree roots are often received from senders who have had drains, walls, houses etc., damaged by roots. The senders want to know which tree has caused the damage and which trees Kew can recommend as more suitable. It is also felt that those who value trees in an urban environment will be particularly glad to know which species or varieties can be planted near to buildings on a range of soil types.

Data cards are being distributed to tree specialists, who are asked to give details of trees with which they are dealing, such as the species of tree, its location, height, condition, root type and its distance from buildings, drives or walls. As they go about their work, the specialists have been asked to fill in all the required details and then post the cards to Kew. When sufficient cards are returned, the information on them will be analysed and then published in a collected form, which will be made widely available.

Planning Farm Buildings

D. M. Andrew

A DECISION to erect new farm buildings is often connected with a change in the farming system; possibly an increase in stock, the introduction of a new enterprise or perhaps to reduce labour requirements and improve working conditions.

Once the decision is made there is a natural desire to have the buildings erected quickly. Superficially, buildings for a particular purpose may appear to be uniform in character and, with standardization, suppliers will try to persuade a likely customer to purchase their particular product. However, time spent planning a layout thoroughly to suit the particular requirements in mind, even though it incorporates a standard type of building, is worthwhile and is essential to achieve good functional design and appearance. Also thorough planning before obtaining firm estimates will avoid the need for extra work and changes during construction; so often these seem to cost much more than expected.

To make sure that nothing is forgotten, it is necessary to consider not only the design of the building but also its relationship to other buildings on the farm. In addition to the plan of the building, a site plan, even if it is only a sketch, will enable all work and movements in and around the building to be planned logically.

Necessary steps

First are the financial arrangements; these may involve a loan and probably applying for a grant towards the cost. Planning and Building Regulation requirements must be met and it may be necessary to consult a River Authority about pollution dangers. Generally, farm buildings (except houses) are exempt from planning consent except when they are over 5,000 square feet in area, over 40 feet in height, within 80 feet of a trunk or classified road or within designated 'areas of outstanding natural beauty'. If other buildings have been erected within 100 yards of the proposed building during the previous two years these must be taken into account in assessing the 5,000 square feet exemption limit. Farm Safety Regulations, Milk and Dairies Regulations and Welfare of Livestock codes must be considered as well. Early consultation about these matters will enable a building to be designed that meets the various requirements.

Choosing the site

Shelter, aspect, appearance, access, drainage and inter-relationship with other buildings affect the design. Where possible it is best to choose a site that allows for further extension.

In hill areas, steep slopes are a limiting factor sometimes. However, modern bulldozers can move large quantities of soil comparatively cheaply

and often a sloping site can be used to advantage. A raised approach to a clamp-silo is an instance of this.

Size and ancillary works

Certain things are straightforward; for instance a cubicle shed to house 50 cows. However, it is also necessary to make sure that there are adequate arrangements for storage of fodder, disposal of slurry, feeding space for the cows and access to and from the parlour. Too frequently grain silos have been erected one year, only to be taken down again the following year so that an extension could be added. With livestock buildings, ancillary works —concrete approaches, slurry stores, drainage—can amount to one-third of the cost; forethought in planning these to cut out unnecessarily extensive areas of concrete, etc., is one way to reduce the overall cost of buildings without impairing their usefulness.

Adequate ventilation is most important. For cattle buildings much can be done by cladding the sides and gable with space boarding and by the provision of adequate ridge ventilation. Where wide span buildings adjacent to a barn are required, often it is better to split the roof line and erect adjacent ridge roof buildings rather than leantos. This improves the flow of air and is not more expensive; lighter portal frames can be used to support the roof and purpose-made and effective valley guttering is readily available.

For the more specialist type of stock building, additional insulation to floor, walls and roof together with fan ventilation may be necessary. When calculating the fan ventilation requirements account should be taken of peak loading rather than average requirements.

Reduced maintenance

There is a relationship between initial capital cost and future maintenance costs. Cheap flimsy buildings are not always the 'best buy'. By making sure that the building is robust enough to stand up to the uses to which it is to be put and by attention to detail, maintenance costs can be reduced. Adequate roof and surface water drainage, careful positioning of downpipes away from vulnerable corners, fitting sliding doors to large openings that are used regularly, and use of timber treated with a preservative are typical points of detail that can help to reduce maintenance costs.

Appearance

The landscape of Britain is largely man-made; traditional buildings were constructed of local materials and so fitted into the landscape. Modern wide span buildings with low pitch roofs do not blend so naturally with the landscape and older buildings; therefore more care is needed with their design. Sometimes it is possible to avoid a skyline site or to retain trees around the building. Use of dark coloured roof cladding and provision of side cladding over walling can help to give 'form' to a new building and ensure that it blends with the landscape and any adjacent buildings. So often it is changes made during the building process that result in the untidy appearance of modern farm buildings. Choice of the right materials and care about cladding and door lines can improve both the appearance and functional use of the building.

Conclusion

Planning a new building involves the reconciliation of many inter-related factors, regulations and statutory requirements. Time spent thinking about these and visiting other farms to see similar buildings is worthwhile. Whether a new building will prove to be good, bad or indifferent in function and appearance depends largely on the amount of forethought given to it before starting work.

D. M. Andrew, A.R.I.C.S., M.R.A.C., is a Surveyor with the Lands arm of A.D.A.S., at Newtown, Montgomeryshire.

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Ministry Publications

Since the list published in the November issue of *Agriculture* (p. 500) the following publications have been issued.

MAJOR PUBLICATIONS

BULLETIN

No. 193. Pig Husbandry and Management (Revised) 68p (by post 73½p)
(SBN 11 241493 1)

TECHNICAL BULLETIN

No. 25. Diseases of Cultivated Plants (New) £3 (by post £3·21)
(SBN 11 240885 0)

MECHANIZATION LEAFLET

No. 29. Pipeline Feeding of Pigs (New) 8½p (by post 11p)
(SBN 11 240687 4)

FREE ISSUES

ADVISORY LEAFLET

No. 339. Chrysanthemum Eelworm (Revised)

HORTICULTURAL ENTERPRISE

No. 4. Carrots for Processing (New)

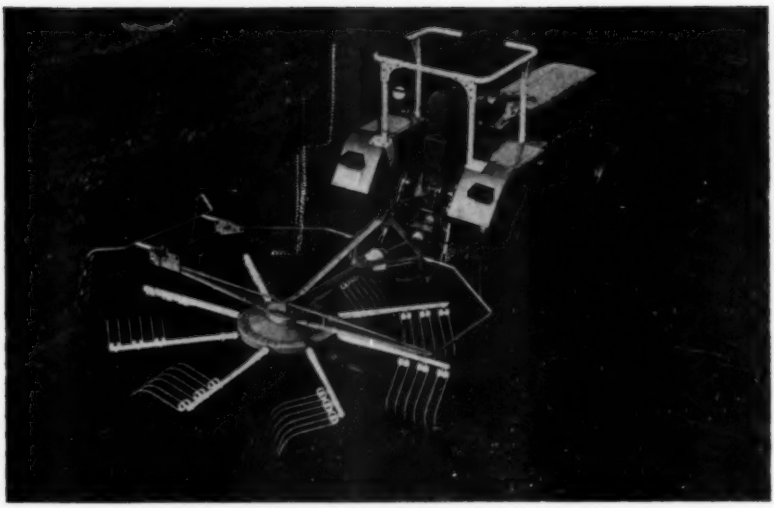
SHORT TERM LEAFLETS

No. 76. Oil-Seed Rape (Revised)
No. 145. Pheasant Incubation (New)

UN-NUMBERED LEAFLET

Farm Safety—Farmer's Lung (New)

Priced publications are obtainable from Government Bookshops (Addresses on back cover) or through any bookseller. Single copies of free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex, HA5 2DT.



Rotary windrower in Germany

A visit to the Federal German Republic to study techniques of

Hay Mechanization in Germany

P. L. Redman

In many of the upland areas of Britain, 90 per cent of fodder dry matter is in the form of hay, and over 90 per cent of holdings employ two or less full-time male workers. Consequently, any possibility of increasing the degree of mechanization of the hay crop, which at the same time provides the opportunity to improve fodder quality, deserves careful attention.

Many farms will continue to make hay owing to the amount of new capital often required to provide loose housing and self-feeding arrangements for silage. Haymaking as commonly practised in Britain, however, presents two main problems:

(i) the long unpredictable field drying time and consequent weather risk militate against improving quality by preventing the consistent cutting of the crop at a younger stage of growth;

(ii) a system based on the current size of bale is, as yet, difficult to mechanize completely and economically on smaller farms.

Parts of southern Germany have broadly similar characteristics in terms of farming type and topography, and since the farms are usually one-man

units the degree of mechanization is even more important. Systems of mechanized haymaking have been based on loose hay and some are now well developed. A programme of visits kindly arranged by Professor G. Segler, Institut für Landtechnik, Hohenheim, Stuttgart, enabled some first-hand impressions to be obtained.

Area visited

Some of the geographical, agricultural and economic features of the area have particularly influenced the development of the systems of conservation, and they are relevant when considering the application of similar techniques to conditions in Britain. Most of the farms visited were in the Allgau, a district situated to the north of Lake Constance and renowned for the production and use of grass. The topography of the area is gently undulating, with a shallow depth of freely drained soil. Total rainfall is typically 1,200–1,400 mm (48–55 in.) and snow covers the area up to 1m (39in.) in depth for up to six months of the year.

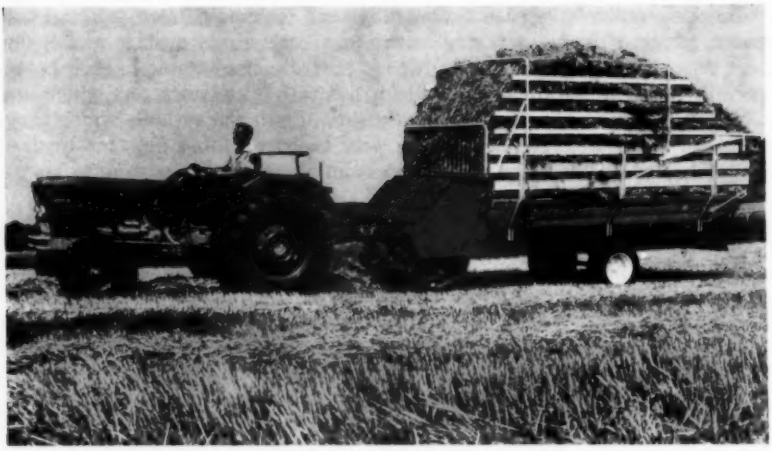
Most of the concentrated cereal feedingstuffs are now imported into the area, and this, coupled with a 200-day winter feeding requirement, results in an economy highly dependent on quality fodder. In addition, there is considerable financial incentive for the farmers to produce milk for cheese, in return for which they agree not to feed silage or any feedingstuffs derived from animals, such as fishmeal; thus again more emphasis is placed on the quality of the fodder. The result is that farmers there may be more inclined to adopt methods of improving hay quality and be prepared to commit more capital to this end than their British counterparts.

During the last ten years typical farm size has increased from 10–15 ha (25–35 ac) to 20–25 ha (50–60 ac). Normally some nine-tenths of the farm is used for grass, with seed mixtures consisting of 70 per cent grasses, 20 per cent legumes and 10 per cent other herbs. Strict management and regular cutting are required to maintain the balance of the sward, and at least four cuts are taken annually.

Building pattern

Due to the long presence of snow, the aim in building design has been to concentrate all winter activities under the same roof, or in buildings which are close together. Two-storey buildings with loose hay stores above the cattle are common. Building design which incorporates the possibility of gravity assistance or limited transport distances renders the handling of loose hay, after the storage stage, a practical proposition. This is, perhaps, the biggest single difference between the hay-making systems practised in Germany and Britain.

The aim is to develop a hay-making system with preferably only one day field weather risk and which is capable of handling each cut within 6–8 working days. To satisfy these requirements, hay has to be loaded into the barn on occasions at 40–50 per cent moisture content, so that some drying is necessary. It is generally accepted that loose hay has drying characteristics superior to those of baled hay, and attention has therefore been focussed on methods of handling loose hay and of achieving satisfactory drying from relatively high moisture content.



Loader wagon in Germany

Field techniques

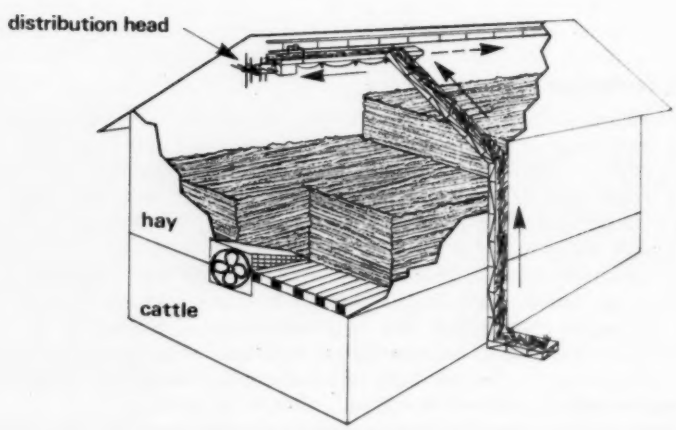
Mid-mounted cutterbar mowers are commonly used to cut the herbage at a young leafy stage of growth when it is 300 mm (12 in.) or less in height. This is immediately followed by tedding, up to three times, with an inclined rotary head type of machine. Finally the material is put into windrows, using a rotary haymaker, prior to being picked up by loader-wagon. When it is necessary to leave hay in the field overnight, it is similarly windrowed to reduce moisture uptake. Methods of improving the rate of drying using conditioning devices, such as crimpers, or by more frequent tedding have been thoroughly investigated. But these techniques were found to be undesirable due to leaf shatter and consequent high field losses, particularly of the more sensitive herbs. For the same reason the rotary windrower is replacing the fingerwheel rake for windrowing.

Loader-wagons are used almost exclusively for picking up and transporting the loose material. Initially developed ten years ago by Herr Ernst Weichel, they now number in the order of 300,000–400,000 in the Federal Republic alone. Balers are used only where it is expected to transport the hay for long distances after storage. Basically all models of loader-wagon intended for handling loose material use a form of pickup reel fitted with a height control wheel. The material is then moved into the body of the wagon by some form of packing device; this can be reciprocating tines or tines mounted on an endless chain, etc., and accounts for the biggest variation between models. The aim is to load the wagon with small blocks of material to assist packing and subsequent handling. Chop length is varied by fitting knives in the path of the material. When picking up fresh material, knives are not normally fitted. Chain and slats on the bed of the wagon are operated by a ratchet so that the body is completely filled. When emptying, the rear gate is lifted and the same chain and slats discharge the load.

Loader-wagons have been successfully used to handle green material cut direct, silage at 30 per cent dry matter, hay, straw, maize silage and sugar beet tops. Their popularity in Europe is partially attributable to their being suitable for one-man operation and for use with 30 h.p. tractors which are common; furthermore, they are vastly superior to the systems which they replaced. Since most fodder systems were based on loose hay, the loader-wagon has never had to be considered as an alternative to existing balers.

Handling in the barn

The majority of handling systems are based on the pneumatic conveyance of loose material, which requires considerable hand labour during both filling and emptying. Three other systems have recently been developed and are now being installed on some farms. With one system, the material from the loader-wagon is discharged into a chain and slat elevator which feeds a horizontal conveyor suspended in the roof of the building. This conveyor runs backwards and forwards automatically along the ridge and distributes hay in even layers, without intermixing, by means of contra-rotating reels.

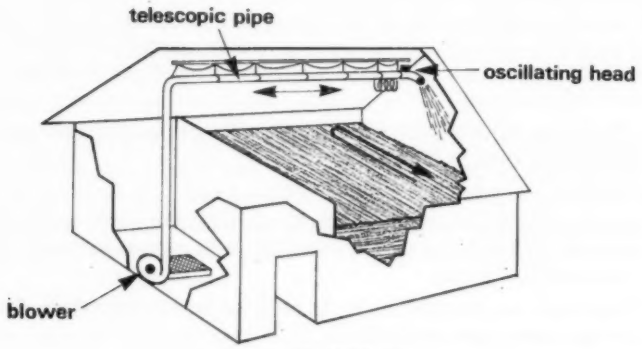


Mechanical Distributor

Storage in even horizontal layers avoids local compaction and improves the drying process, so that it is reputedly possible to dry hay from a moisture content as high as 60 per cent at loading. Fodder has to be removed by hand, but this is a relatively easy process when hay is stored directly above the cattle.

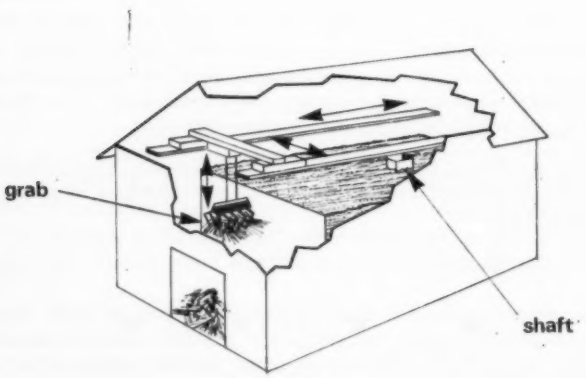
The second system is used in conjunction with a pneumatic blower, and consists of a telescopic horizontal pipeline supported in the ridge of the building, with a swivel bend at the outlet. A small motor extends and contracts the telescope and at the same time oscillates the swivel head, thus

distributing layers of hay over the whole area. It is a system more suited for hay below 45 per cent moisture content, since damp hay tends to cause blockage in the pipeline and becomes consolidated in store, due to the compacting effect. As in the previous system, removal has to be by hand.



Pneumatic distributor

A third system permits complete mechanization of both loading and unloading the store. This consists of a remote control grab capable of movement in the vertical, horizontal and lateral planes. Distribution is not as even as with the former two systems and, consequently, it is desirable to have hay at less than 45 per cent moisture content at loading. The same grab is used to empty the store by dropping hay either into a fodder wagon or through a shaft directly on to a conveyor system. This installation requires buildings to be of standard dimensions, and many of these have been erected in the last two years. Facilities to complete the drying of hay in store are commonplace in this part of Germany.



Bridge-Crane grab

Conclusions

Systems of handling and drying hay in the loose form are now capable of a high degree of mechanization and provide the potential for one-man operation. Recently introduced systems of distributing and drying the hay in store from high moisture content reduce the weather risk and allow fodder quality to be improved significantly. The design of the buildings and the relatively small herd sizes favour unloading loose hay from store by hand.

The obvious question then is 'Will these systems be applicable to British conditions?' Any answer to this question must consider the ways in which farming conditions in southern Germany differ from those in Britain. These are:

(*a*) Farmers in Britain are not commited by factors outside their control to conserving grass in the form of hay.

(*b*) The bale is the usual method of handling hay.

(*c*) Existing building design does not favour handling hay in the loose form beyond the storage stage; in many cases hay is stored some distance from where it is fed.

(*d*) Herd sizes are generally larger than those found in southern Germany and are tending to increase.

On many farms in Britain the bale forms a convenient method of handling from store to the feeding point, which is often some distance away. It is doubtful if a loose hay system can be convenient in these respects unless some form of self-feed or easy-feeding system can be devised which could be used in existing buildings. With an easy-feeding system it would be difficult to retain the advantages of rationing which the bale provides and at least some modification of the hay barn and the housing of stock nearby would be necessary. A change to a self-feed silage system would be similar, and can reasonably be assumed to involve a similar capital outlay. Self-feed silage systems on the other hand have now been developed to a high degree of mechanization and require the minimum field weather risk, thus providing more opportunity to conserve grass at the optimum stage of growth. Capital outlay is still a critical factor for those considering changes in their conservation system, and it is this which has impeded the adoption of improved techniques such as barn dried hay and self-feed silage in the past.

Apart from some individual farm situations, therefore, it is unlikely that techniques based on loose hay will be adopted on a wide scale in Britain. If, in the unpredictable future, other powerful factors favour the use of hay in preference to other forms of conservation, then the techniques currently being developed in southern Germany offer the basis of a mechanized system with a potential for producing high quality hay.

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15. Devonshire

A. J. Brown

THE farming area of Devon consists of some 1,150,000 acres of crops and grass, of which only 25 per cent is devoted to arable crops, together with 300,000 acres of land classed as rough grazing. There are 7,678 holdings of over 50 acres, with the greatest number in the range 50–150 acres; only 133 are over 500 acres. A number of the smaller units are part-time holdings.

Geology and soil

Geologically the county forms a broad syncline with an east to west axis. Rocks of the Lower Devonian series outcrop in the north and south of the county and give rise to well-structured, free draining soils. Towards the centre of the county, soils are derived from the Middle and Upper Devonian rocks and Culm measures; they are variable, mainly shales with some sandstone and containing a high proportion of silt. The Culm soils are notoriously difficult to drain and to manage, and tend to occur in an elevated and high rainfall area in the west of the county.

The area of redland which is such a prominent feature of the county along some holiday routes is of limited extent. It runs as a gradually narrowing tract of land ending in the Culm soils in the centre of the county.

Soils derived from the granite from which Dartmoor is formed tend to be light and fairly free draining on the fringe of the moor, but deficient in lime. Those of Exmoor which are not derived from granite are free draining and more fertile.

Rainfall

There is very wide variation in the rainfall of the county. It ranges from about 30 inches bordering the Exe Estuary to about 35 inches along the Teign and Taw estuaries and rises generally with elevation to a maximum of 70 inches on the uplands of Exmoor. Certain parts of Dartmoor have a rainfall in excess of 70 inches. Over much of the county the rainfall is in the 40–50 inch band. There is considerable variation in the amount of summer rainfall. East Devon frequently experiences a summer drought; this is rare in the western and northern parts of the county. The tendency in recent years has been for autumn to be mild and often with good grass growth, but for spring to be late with dry, cold conditions not favouring the growth of grass or cereals.

The wide range of geological and climatic factors occurring within the county results in a mixed pattern of farming and great variation in scenery so attractive to the tourist. It does, however, provide a challenge to both farmer and adviser.

Farming systems

The farming systems adopted in this county are mainly the result of soil and climatic conditions. Grass is the crop which grows par excellence in most parts of the county, and as Devon farming is mainly concerned with livestock the arable crops grown are mainly used for stock feeding.

In 1944 the county cereal acreage reached 297,235 acres, then declined to 180,274 acres by 1971. During the sixties there was a fresh interest in barley and the acreage rose to 164,866; but leaf diseases such as rhynchosporium and mildew reduced grain yields and in 1971 the acreage had fallen to 124,871. Corn is grown in small amounts on many of the smaller farms, partly to provide grain and partly for straw as bedding material. Some wheat is grown to provide reed for house thatching purposes. Potato growing is confined mainly to the larger farms on the lighter soils and much of the crop is sold as second earlies to meet the demand from the influx of summer visitors. Root and green crops make an important contribution to livestock feeding. Swede growing for human consumption is practised on the redland soils of South and East Devon.

Cattle and dairying

The county is unique in having two native breeds of cattle, the South Devon of mellow tan colour and Red Devon or 'Red Ruby'. The South Devon is a native of the southern part of the county and still confined to that favoured part of the county with soils derived from Devonian shales. It is the largest of British breeds, produces relatively high butter fat milk and has a great propensity for growth and for imparting this factor to other animals. The bulls of the breed, therefore, are in great demand for crossing, not only in this country but also overseas. In spite of their great size, they are extremely docile. This ability to grow rapidly has only fairly recently been realized by farmers in other parts of the country and calves are in great demand at high prices. The Red Devon is native to North Devon and has a dark reddish brown colour. It is essentially smaller than the South Devon and a very compact beef producing animal. It crosses well with the Friesian but unfortunately does not colour mark the offspring.

Dairying is by far the most important single enterprise and produces over 40 per cent of the gross output. The Friesian is now the dominant breed and dairy herds have expanded in size since 1960 with numbers rising from 141,481 cows and heifers, then, to 165,540 in 1971.

Dairy farming in Devon has, in recent years, developed both in intensity and efficiency. Not only has the quantity of milk per producer increased, but there is also a small but definite trend for an increase in yield of milk per cow. Bulk milk collection has increased rapidly since first introduced five years ago, and now there are over 1,400 bulk tanks installed in the county; a little over half of all milk produced is collected in bulk.

During the same period, 1960 to 1971, the beef herd expanded from 39,978 to 48,667. In addition to beef production within the county, there is a considerable export of animals to other parts of the country for fattening in yards. Also, in recent years there has been a growing export of beef and lamb carcase meat to the continent.

Because of increasing rents and costs, milk production has become a necessity on a number of lowland farms where previously beef production

had been the traditional system. On many farms the Red Devon has been displaced by the Friesian.

Sheep

The native breeds of sheep are the Devon Longwool, Dartmoor, South Devon, Devon Closewool and Exmoor Horn. The first three of these breeds are all longwool types.

There are two separate types of Dartmoor sheep, the Greyface and the Whiteface. The South Devon is the largest of the breeds, and ewes will shear about 15 lb of wool. In the past, wool production was a very important part of the sheep enterprise. However, since the introduction of man-made fibres and a lessening demand for wool, more emphasis is being placed on lamb production and many breeds and crosses are being bred for optimum profitability. Sheep, after having been in the doldrums for many years, have been in great demand this year with enhanced prices for breeding ewes at recent sales.

In the more favoured parts of East and South Devon, lambing can start as early as September with Dorset Horn or Dorset Down crosses. It continues according to elevation and climatic conditions throughout the winter period, the latest lambing taking place on the hills of Dartmoor and Exmoor in spring.

Horticulture

Horticulture is mainly located in the eastern and southern parts of the county with relatively low rainfall and, incidentally, also lighter and more friable soils. A flourishing co-operative growing and marketing organization for fresh vegetables has been established in East Devon. Many of the older glasshouses are being replaced by more modern structures, and a considerable effort is being made to meet the challenge of the Common Market.

Tourism

Devon and Cornwall continue to attract many holiday visitors and tourism vies with agriculture in Devon for pride of place as the county's largest industry. More and more farmers are taking advantage of the demand for holiday accommodation, or the provision of temporary caravan or camping sites. A number of farmers on holiday routes or near holiday centres supplement their normal farm output by 'farm gate' sales of fresh potatoes, cream and eggs.

New Food Exhibition for 1973 Royal Show

Plans are being made to hold a Food Exhibition in conjunction with the Royal Show next year.

It is felt that since agriculture and food can be regarded as complementary when displayed side by side it would be appropriate that the Royal Show, which is already the shop window for British agriculture, should promote food similarly. Pressures from Europe are increasing. Several overseas food organizations are involved in promoting food at the Royal Show and others are likely to come in 1973. Figures recently issued by the Royal Agricultural Society indicate that a record number of 3,124 buyers from ninety-six countries attended the last Royal Show.

The Royal Show will be held at the National Agricultural Centre, Stoneleigh, from 2nd to 5th July.

in brief

- **Soft fruit in the E.E.C.**
- **Fire precaution pointers**
- **Soil care**

A forest in transition

Soft fruit in the E.E.C.

WHAT future awaits British-grown soft fruit in the E.E.C.? Since 1970 a sub-committee of the Economic Development Committee for Agriculture, headed by Sir Gwilym Williams, has been probing this question and now reports in a N.E.D.O. publication, *Soft fruit: U.K. farming and the Common Market**, that the market barometer is set fair; opportunities for expansion will unquestionably exist, but the quality of the produce and its marketing will have to be improved. Raspberries, blackcurrants, blackberries and loganberries, classes of soft fruit in which Britain has advantages of climate over her continental partners-elect, can be considered to offer good prospects; and to these, of course, will be added tariff-free entry. The report is not only concerned with fresh fruit, but also with the commercial enterprise that stems from the extension of processing and freezing.

Though advantage in early strawberry production will go initially to E.E.C. growers, during the peak season (mid-June to end July) low prices will militate against imports and British growers will accordingly face little competition during the late season, particularly since supplies will be of a better quality and the market is close at hand. Given a longer shelf-life by the use of cooling facilities, an increasing demand from retail outlets can be expected. Roadside sales and self-picking enterprises have been increasing during recent years and could constitute an important part of the market. It is felt, however, that research should be continued to produce a high-yielding and darker-coloured strawberry and that more emphasis should be placed on breeding for flavour. Strawberries for processing, on the other hand, are likely to be under greater competitive pressure, especially from Eastern Europe, which is already entrenched in the E.E.C. Canned strawberries may offer an attractive market (subject to permitted colouring legislation) when other canned fruits from the Commonwealth and South Africa are required to pass a tariff barrier.

The report forsees the possibilities of a very gradual expansion in raspberry production, to which entry into the E.E.C. should give added impetus. The British grower is in a good competitive position, and it is of more than incidental interest that the demand for fresh raspberries and for some derived manufactured products has by no means been fully exploited either in Britain or the E.E.C. But because of the scarcity of labour and its cost, research into the perfection of a mechanical harvester is seen to be a matter of urgency. Supplies must also be of a high quality and a good distribution and marketing organization will be essential.

In blackberry and loganberry production, climate again gives us more than the edge over the E.E.C., which is a net importer of these fruits. We also have an advantage in gooseberry growing, but here again we can expect strong competition

*Available free from N.E.D.O., Millbank Tower, Millbank, London, SW1P 4QX.

from Eastern Europe where there may be a predominating need to earn foreign currency by seeking low-priced outlets.

How important it will be for growers to have access to a comprehensive market intelligence if they are not to engage in a kind of blind man's buff is self-evident. This report envisages further investigation, but the information already given is certainly such that no fruit grower can afford to be unacquainted with it.

Fire precaution pointers

THERE'S more to fire precaution than taking out insurance. Looking around any farm with the keen eye of a fire protection officer, danger is seen to lurk in dozens of situations and unforeseen circumstances. The modern miscellany of machinery, engines and vehicles, stored paraffin and oil, heating apparatus, buildings, etc., which characterizes the modern farm, imposes high risk. In the past ten years the immediate cost of major fires on farms has risen from under £500,000 to nearly £1¾ million, and to these figures must be added the consequential loss and the disruption of normal working for protracted periods. Only a spark is needed to start a conflagration, and whilst the laws of chance cannot be entirely eliminated, their operation in any given set of situations can be considerably reduced. The pointers to farm fire precautions are well made in a recently issued 12-page guide* which, if followed, could save much anxiety and ineffectual regret.

The inspection of electrical and heating installations and all classes of equipment is an obvious (if not infrequently neglected or postponed) routine, and carelessness on the part of smokers and the thoughtless use of naked lights are fire risks which should need no emphasis. But the provision of adequate water supplies, first-aid fire fighting equipment, a clear indication of the site of the farm, and even a wide enough farm gateway to give access to the fire brigade are points which have not necessarily occurred to the majority of farmers. For a 'premium' of 20p, this guide could be a gilt-edged investment. Like liberty, the price of fire safety is eternal vigilance.

Soil care

IT may be stating the obvious to say that the soil is the farmer's primary asset, yet not infrequently it is taken for granted, unrecognized that it is continually changing in composition and structure in response to the aggregated influences of cropping and cultivation. Under conditions of all-arable rotations and declining levels of organic matter, soil structure can deteriorate rapidly and associated drainage problems can put whole fields at risk, if not out of commission, irrespective of the type of soil. The main damage to soil structure, however—consolidation and panning—occurs as a result of cultivating when the ground is too wet, and this applies particularly to clay and silty soils. A well-structured soil, in which the component particles are in a kind of optimum association, consists of about 50 per cent solid matter, 20 per cent air and 30 per cent water at field capacity, which allows for a network of worm channels and fissures that facilitate plant root exploration, water drainage and movement of air. The use of heavy farm machinery at the wrong time, compacting the soil by smearing, initially creates a barrier in the profile by sealing off holes and natural cracks and so effectively prevents the essential downward movement of air and water. Discs, cultivators and rotary cultivators can also cause similar sealing of layers at the depth of cultivation. Neither is this horizontal smearing at the bottom of cultivation layers the whole story, since vertical smearing can also be caused by the use of planting machines in wet weather.

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*From the Fire Prevention Information Centre, Aldermary House, Queen Street, London EC4 1TJ price 20p.

A healthy soil should show a uniform colour throughout its profile, so that a visual inspection can often give the first clue to unproductiveness. Where mottling is apparent, poor drainage, probably the result of compaction, is to be suspected. Large, flat angular surfaces, which reflect more light, show up brighter than the surrounding soil; or by reason of the absence of air, they may be of a greyer colour. An examination of the physical state of the soil and recommendations for remedial treatment form the subject of the Ministry's Short Term Leaflet 114*, with special regard to subsoiling to break up the deeper pans. The depth of compaction can be readily ascertained by spade or soil auger. Apart from the free movement of water and air, an open soil gives a more efficient fertilizer distribution. Hence crop response is higher all round.

A forest in transition

To many people mention of the Forestry Commission conjures up nothing but vast acreages of gloom-laden stands of conifers. Indeed that image is excusable in face of the emphasis on the predominantly softwood policy of the past fifty years necessitated by the country's need for quick-growing timber. But that this is a purely superficial view was clearly demonstrated earlier this year when Friston Forest, on the Sussex Downs, was revealed in its true nature as a *beech* wood comprising three million trees. The pines are now seen merely to have been 'nurses' to protect the infant broadleaved trees which will in the course of time add their glory in a native setting to this stretch of the south-east coast. There was a symbolic felling of pines to introduce a programme of five-yearly thinnings which will steadily bring about a metamorphosis according well with the new forestry policy that brings amenity, recreation and wild life conservation to the fore.

Currently, the silvicultural make-up of Friston Forest, which covers 1,984 acres (1,544 acres planted), is 68 per cent mixed conifers and hardwoods, 27 per cent pure broadleaved and 4 per cent pure conifers. The transition from pine to beech will be made at the rate of 100 acres a year, so that in ten to twelve years' time, with a few exceptions, the whole forest will be pure beech.

AGRIC

*Free from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middx. HA5 2DT

CORRECTION

In the 'In brief' article in the October issue of *Agriculture* under 'Rats, mice and abnormality' lines 20 and 21, page 459, should have read 'switching to other toxic rodenticides, such as zinc phosphide and, for mice in buildings' where environmental temperatures are not higher that 18°C, alpha-chloralose and *not* 'switching to other toxic rodenticides, such as zinc phosphate and, where environmental temperatures are not higher than 18°C, alpha-chloralose'.

ACKNOWLEDGMENT OF PHOTOGRAPHS

We gratefully acknowledge permission to use the following photographs:

P. 527, Bolton and Paul (Steel Construction) Ltd.
Pp. 531 and 533, The North of Scotland College of Agriculture.
Pp. 539 and 541, Fahr. A.G.

Books

Pea and Bean Growing Handbook. Vol. I. Peas. Pea Growing Research Organisation.

The P.G.R.O. are to be congratulated on their new production; not only in the maintenance of their usual high quality of technical expertise and attractiveness of presentation but in employing a loose leaf folder. With the increasing pace of technical developments, publications date so quickly that the expert is seriously deterred from expending his energies on definitive publications.

Only time will tell how close to the ideal solution the P.G.R.O. have reached, but it will be watched with great interest. How well will it wear? How well will they cope with the problem of distributing replacement and additional items? A useful aid in this respect would be for each section to be dated.

This is a truly comprehensive guide to the pea crop and its problems, a 'must' for growers and students alike. Wisely the sections on weeds and on pests and diseases deal with principles and descriptions, with separate supplements on herbicides and pesticides, so reducing the quantity of replacement material on aspects where revision is most frequent. It is to be hoped that P.G.R.O. will never hesitate to produce amendments to slip in the folder whenever an item becomes out-dated e.g., acreages and varieties.

Soils do not seem too well understood; 'water table' is used where 'moisture capacity' is meant. Seed should not be 1½ to 2 in. deep; except for late drillings when the soil may be dry, they invariably perform best when only just covered. Rolling is needed only to give a flat enough surface to avoid cutter bar blockages.

The economics section is perhaps least satisfying. The gross margin system would have been more effective and allowed for a simpler presentation. Rents are high. A wider range of farm situations would have been helpful.

One wonders why there is less detail in the Handbook than in some of their miscellaneous publications—it would have been helpful if collections of the latter could now have been discarded.

Copies of the book are obtainable from the Secretary, Pea Growing Research Organisation, Great North Road, Thornhaugh, Peterborough PE8 6HJ., price £2·50 (postage 15p).

J.M.P.

Meteorological Glossary. 5th Edition. Dr. D. H. McIntosh. H.M.S.O., 1972. £2·75.

The fifth edition of the Meteorological Glossary has been prepared by Dr. McIntosh of the University of Edinburgh with co-operation from within the Meteorological Office. This is a happy arrangement and has resulted in a first rate book of reference of value to both the official meteorological service and to a wide range of others interested in particular aspects of weather and climate. It is intended to provide a brief definition of all of the meteorological terms rather than a collection of miscellaneous articles by various experts. As a result some of the entries are very much shorter than in previous editions; that on heat for example is reduced by about 90 per cent but this is no loss as most of the omitted material can be found in text books.

Meteorology as a study is even more embracing than agriculture in that it deals with the whole of the earth's surface and not only the land portion; further, for many years it has been concerned with the higher parts of the atmosphere and is now reaching out into space. There is therefore an extremely wide range of entries, from field capacity to sea temperature and from microclimate to satellite sounding. On a less serious note, St. Swithin's day is despatched with the comment that 'rainfall records lend no support to this tradition', while ornithologists will be surprised to read that the dawn chorus is a type of radio disturbance which 'is considered to be initiated by extraterrestrial charged particles'.

A number of plates are included, mostly of cloud and phenomena such as rainbows. Some are in colour, some in black and white, and it is strikingly clear that most if not all of the latter would be much improved by colour.

The book is otherwise excellently produced, diagrams are clear even when small and the references and cross references are valuable. At the price it is very good value.

W.H.H.

Agricultural Chemicals Approval Scheme

Sixth List of Additions and Amendments to the 1972 List of Approved Products for Farmers and Growers

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2-AMINOBUTANE

A fungicide for fumigation of seed potatoes for control of skin spot and gangrene.

Liquids

Butafume—BASF

NEW USES OF APPROVED PRODUCTS

AZIPROTRYNE

Now approved for the control of a wide range of annual weeds post-emergence in onions and leeks.

CHLORFENPROP-METHYL

Now approved for the control of wild oats post-emergence in spring wheat.

CHLORMEQUAT

Crops undersown with clover and grass can now be treated.

CHLORTHIAMID

Now approved to kill shoots on potato and mangold clamps and to destroy potatoes and mangolds on old clamp sites. Also for the control of some submerged weeds in still and slow moving water.

DIOXATHION

Delnav 47 is now approved for the control of aphids, tortrix and winter moths pre-blossom and apple sawfly.

LINURON WITH LENACIL

A new mixture has been approved for the control of a wide range of weeds in daffodils, narcissi and tulips.

Wettable powders

Lanslide—Pan Britannica

QUINOMETHIONATE

A smoke formulation has been approved for the control of red spider mites on chrysanthemums, cucumbers and tomatoes.

Smokes

Morestan Smoke Generators—Bayer Agrochem

TERBUTRYNE WITH TERBUTHYLAZINE

Now approved for the control of annual weeds pre-emergence in peas.

TETRACHLORVINPHOS

Now approved for the control of tortrix and winter moths pre-blossom on pear and plum and raspberry beetle.

VAMIDOTHION

Now approved for the control of raspberry mite.

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MANGANESE AND ZINC DITHIOCARBAMATE COMPLEX

Wettable Powders

Shellstar Carmazine—Shellstar

METALDEHYDE

Baits

BASF Slug Pellets—BASF

SIMAZINE

Wettable Powders

Boots Simazine 50 (selective weed control)—Boots

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Second Edition—1971

FERTILIZER TECHNOLOGY & USE

Developments in fertilizer technology and use during the past ten years have prompted the Soil Science Society of America to revise the first edition of FERTILIZER TECHNOLOGY & USE.

The second edition of FERTILIZER TECHNOLOGY & USE is now available and contains the proceedings of the "Symposium on Fertilizer Technology, and Use" held in Chicago on February 11-12, 1971. Edited by R. A. Olson, T. J. Army, J. J. Hanway and V. J. Kilmer, the book contains discussions of the latest information concerning fertilizer production, marketing, and use, and the effects of fertilizers upon soils and the human environment.

This handbook and reference guide would be of interest to industrial agronomists, university and agricultural instructors, farm supply dealers, environmentalists, and of special interest to fertilizer researchers and dealers.

Published by the Soil Science Society of America, December 1971, 611 pages. Illus. Hardbound. $8 (members), $10 (nonmembers) per copy.

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